

The Deluxe Tenna Dipper

Design by: KD1JV

Distributed by: Pacific Antenna, www.qrpkits.com

The "Tenna Dipper" provides a simple means of determining the 50 ohm resonant frequency of an HF antenna or ATU (Antenna Tuning Unit). The small size and battery operation makes the unit ideal for use in the field.

Features:

- Wide tuning range: ~3 MHz to ~30 MHz in two ranges
- Four digit LED frequency readout

Usage:

- Eliminates the need for a transmitter and SWR bridge when:
 - Trimming length of resonant dipole antennas.
 - QRM free adjusting of antenna tuners
 - Quickly adjust short, portable vertical antennas.



How it works:

A voltage controlled R/C oscillator generates a 5 volt square wave signal. This signal drives a resistive Wheatstone bridge. One leg of the bridge is the "unknown" resistance, the antenna. A wide band step up transformer is connected across the bridge to detect the signal produced when the bridge is unbalanced. This signal is further amplified by a Darlington pair transistor amplifier. A high brightness LED is used to visually indicate the current in the collector of the amplifier. When the antenna impedance at the unknown leg of the bridge is equal to 50 ohms, the bridge is in balance and the LED will go out. Hence the name for this device, the Tenna Dipper, as we dip the brightness of the LED to find the 50 ohm match.

Using the Tenna Dipper.

Finding the resonant frequency of a coax feed dipole antenna:

Simply connect the feed line to the Tenna Dipper and adjust the frequency until the SWR indicating LED goes from bright to very dim or completely out. Then read the frequency on the display.

Adjusting an antenna or ATU to a specific frequency (or band)

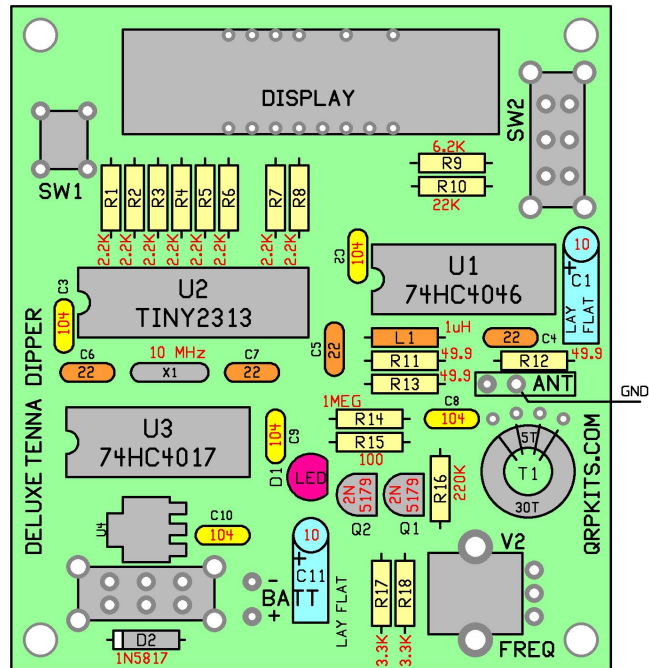
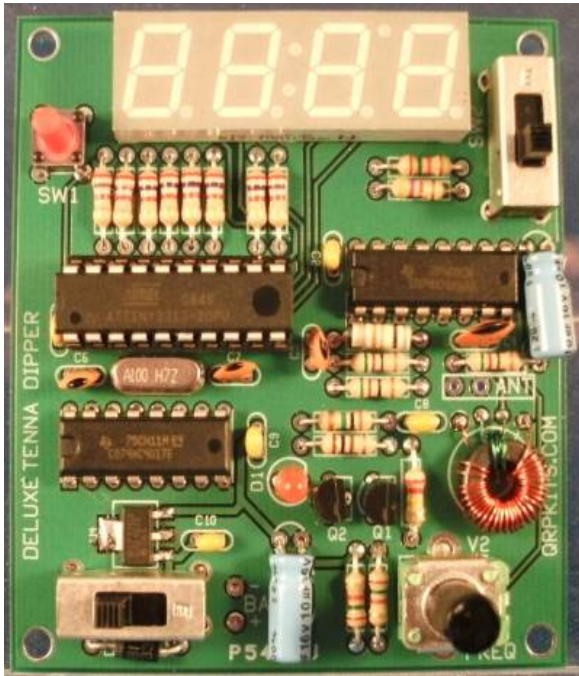
Connect the feed line which will go to the transmitter to the Tenna Dipper and set the oscillator desired frequency. Now adjust the antenna or ATU to make the SWR indicating LED to be very dim or go out completely.

The Tenna Dipper is very handy for adjusting short vertical antennas such as the PAC-12 or MP-1. Set the Tenna Dipper frequency to the desired band and connect to the antenna. You can watch the brightness of the LED from a distance, so you don't have to run back and forth between the antenna and the 'Dipper. Since the proximity of your body to the antenna can affect the match, once the match is close, be sure to step a few feet away from the antenna to make fine adjustments and find the perfect match.

Parts list:

√	QTY	Part number	
	1	CD74HC4046AEE4	U1
	1	CD74HC4017E	U3
	1	ATTINY2313-20PU	Processor, U2
	1	1N5817	Diode
	2	MPS5179	NPN RF TRANSISTOR
	1	MCP1703-5002E/DB	U4, 5V LDO REG
	1	4 DIGT 7 segment LED	Display
	1	T-1 super bright red LED	Indicator LED
	1	10 K LINEAR POT	9 mm potentiometer
	2	DPDT SLIDE SW	SW
	1	6mm / 13mm TAC	PB Switch
	1	RFC 1 uH	Molded inductor
	1	FT37-43 TOROID	Toroid core
	1	10.00 MHz HC49US	Crystal
	4	49.9 OHM 1 %	Resistor
	1	100 OHM 5% 1/4W	Resistor, BRN-BIK-BRN-GLD
	8	2.2 K 5% 1/4w	RED-RED-RED-GLD
	2	3.3 K 5% ¼ W	ORG-ORG-RED-GLD
	1	6.2 K 5% ¼ W	BLU-RED-RED-GLD
	1	22 K 5% 1/4w	RED-RED-ORG-GLD
	1	220 K 5% 1/4w	RED-RED-YEL-GLD
	1	1 MEG 5% 1/4w	BRN-BLK-GRN-GLD
	4	22 pdf NPO 0.1" LS	22 marking
	5	0.1 ufd MONO X7R 0.1" LS	104 marking
	2	10 ufd/16V ALUM ELECTRO	Electrolytic Capacitor
	1	20 pin DIP socket	Socket
	1	2 feet # 30 magnet wire	Wire
	1	BNC Jack	BNC
	1	RED FILTER FILM	2" X 0.75"
	1	CIRCUIT BOARD	PCB
	1	DECAL SET	Decal

Assembly:



- Mount U4 first. This is a SMT (Surface Mount) part. First lightly tin one of the three solder pads which are in a row. Place the part over the pads, (hold part with your needle nose pliers) then use the tip of the soldering iron to heat and gently push on the lead over the pad which you just tinned. Then heat and flow a little solder to all of the leads of the part.
- Next mount all the resistors: (plus RFC and diode)



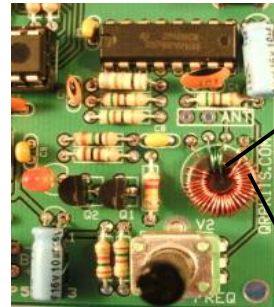
Location	QTY	Value	Color code
R1,2,3,4,5,6,7,8,9	9	2.2 K	Red/Red/Red/Gold
R9	1	6.2 K	Blue/Red/Red/Gold
R10	1	22 K	Red/Red/Orange/Gold
R11,12,13	3	49.9 Ohm 1%	Yellow/White/White/Gold/Brn
R14	1	1 Meg	Brown/Black/Green/Gold
R15	1	100 ohms	Brown/Black/Brown/Gold
R16	1	220 K	Red/Red/Yellow/Gold
R17, 18	2	3.3 K	Org/Org/Red/Gold
L1 (looks like resistor)	1	1 uhy	Brown/ Black/ Gold/Gold
D2	1	1N5817	Note polarity line, match with line on board.

- Now the capacitors:

Location	Qty	Value	Markings/Type
C2,3,8,9,10	5	0.1 ufd	104 monolithic
C4,5,6,7	4	22 pfd	22 NPO
C1, C11	2	10 ufd /16V	Alum electrolytic NOTE: these two caps must be mounted laying flat to the board as shown in photo.

C1 and C11 lay flat to board.

- T1: Wind and mount T1. First wind 30 turns of #30 magnet wire on the black, FT37-42 core.
- Then wind an additional 5 turns in the space between the start and finish of the 30 turn winding.
- Trim and tin the wires ends.
- The 30 turn wire ends go into the two outside pads and the 5 turn winding wire ends go into the two inside holes.



5 turn winding to inside holes

30 turn winding to outside holes.

- Remaining parts

Location	Part	
Q1, Q2	2N5179	Transistors TO-92
U1	74HC4046	16 pin dip IC – DO NOT USE SOCKET – Using a socket here will affect tuning range and stability of oscillator.
U3	74HC4017	16 pin DIP IC – Socket can be used if desired
U2	20 pin IC socket – check for any leads bent over and not sticking through pads before soldering.	Insert Tiny2313 chip into socket after remaining parts on board are installed.
Display	4 digit LED display	Due to missing pins, this part can only go in one way.
X1	10 MHz crystal (A100)	
SW2/3	DPDT slide switches	Make sure switch body is flush and square to board before soldering more then one lead.
D1	Clear LED T1 size	Short leg goes into hole next to flat side of part outline. To get the spacing correct from the board, mount board with LED into case before soldering leads. (Top of LED lens will be about 13/32" from top of board).
SW1	TACT push button switch	
V2	9 mm, 10 K potentiometer.	

- You can now install U2, the TINY2313 into the socket.
- *Wire the battery holder to the board, red wire to the '+' pad and black wire to the '-' pad.*

Testing:

- Make sure the on/off switch is in the off position (slide to left).
- Connect up a power source, 6 to 14 volts. A 9V radio battery or four "AA" cells will do.
- Turn unit ON with the on/off switch.

The frequency display should light up, showing all 8's and decimal points lit for a couple of seconds. This indicates all the segments are working. Then the current frequency will be displayed, in MHz. [xx.xx] MHz The SWR indication LED should be fully bright.

Now check the tuning range of the oscillator by adjusting V2 and the range switch, SW2. Exact tuning range is dependent on component tolerances.

Low range : About 3.0 MHz to 11.7 MHz

High range : About 11.0 MHz to 30 + MHz (note SWR LED will dim slightly above 27 MHz.)

Clicking the display shift switch, SW1, will make the display change from showing the frequency in MHz with 10 kHz resolution to displaying the frequency in kHz, with 100 Hz resolution. This is indicated by the decimal point shifting from between the 2nd and 3rd digit to between the 3rd and 4th digit. In the kHz display range, you will see the R/C oscillator isn't real stable, as the 100 Hz digit will be jumping around. This is normal.

Now test the operation of the SWR bridge by placing the left over 49.9 ohm resistor across the ANT pads. The SWR LED should go out.

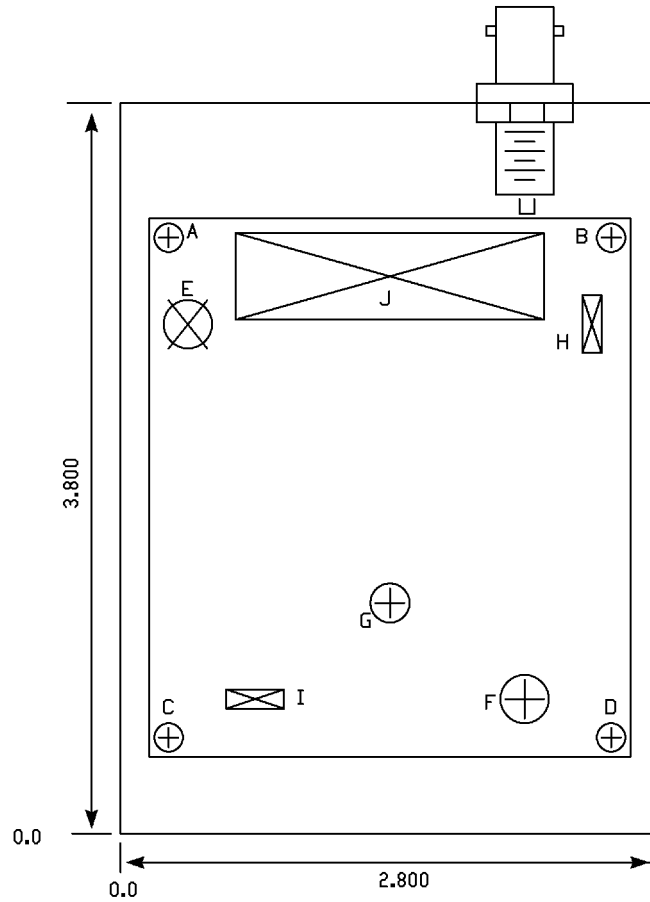
If the board passed all these tests, it is now fully functional and can be mounted in a case of your choice.

The following page provides a template and hole locations.

Front panel hole locations for mounting in a case.

This page should print to scale and can be used as a drill template.

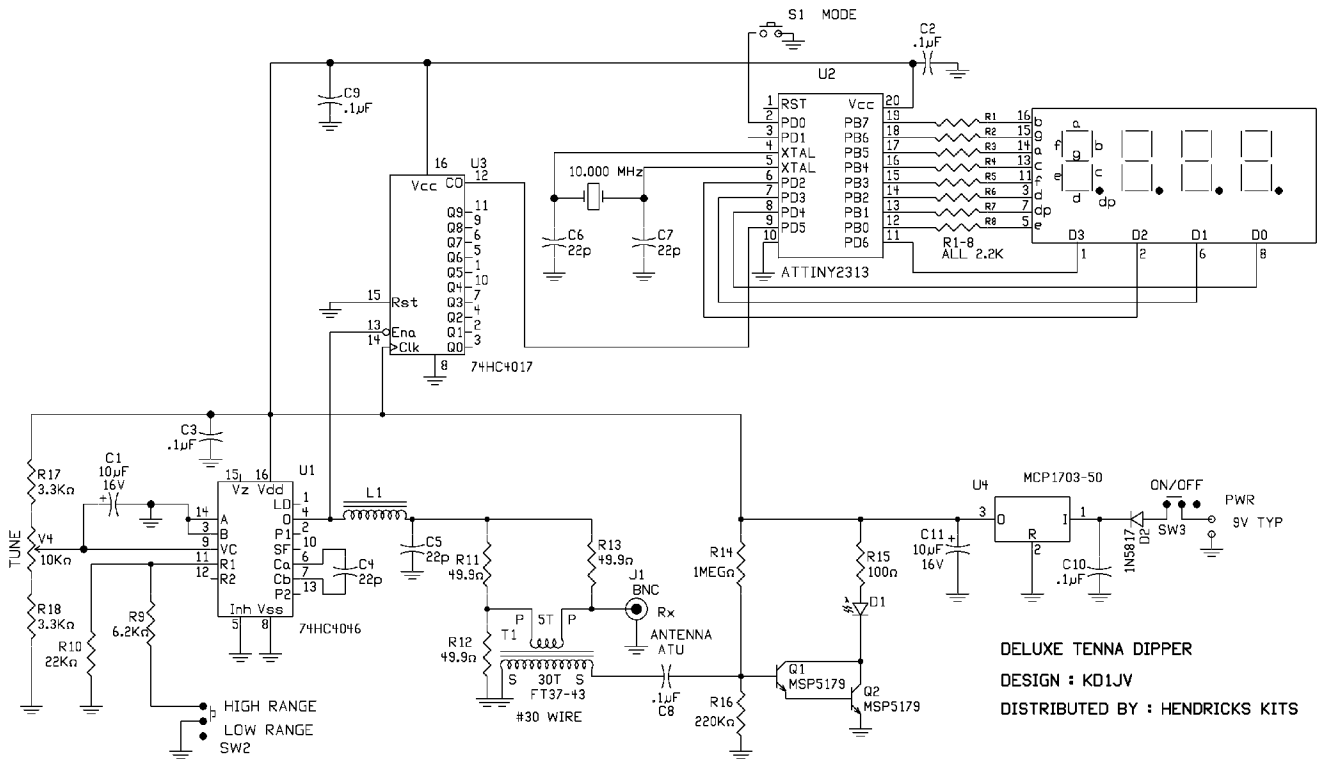
The dimensional chart hole locations below are referenced to the 0.000/0.000 location of the overall panel.



FRONT PANEL HOLE LOCATIONS

HOLE	SIZE	X	Y
A	#4 PEM 0.325"	0.500	3.100
B	#4 PEM	2.550	3.100
C	#4 PEM	0.250	0.500
D	#4 PEM	2.550	0.500
E	0.25" dia	0.350	2.650
F	0.500"	2.100	0.700
G	0.125"	1.400	1.220
H	0.160 X 0.350 (XY)	2.450	2.650
I	0.350 X 0.160	0.700	0.700
J	1.600 X 0.500	1.400	2.900

Schematic:



Decal layout:

