E202VAR Natural Radio Receiver v1.3

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Introduction

This project is based on the Explorer E202, with permission.

Renato Romero put plans online for a Very Low Frequency (VLF) receiver capable between "a few Hz to beyond 10 kHz [which] makes it suitable to to receive radio signals of natural origin; signals not generated by human activity but by physical phenomena such as lightning and solar storms. Received signals are heard directly in your headset. The receiver amplifies the electric component of an electromagnetic signal."

His plans are described here. The Explorer E202 is no longer available for sale.

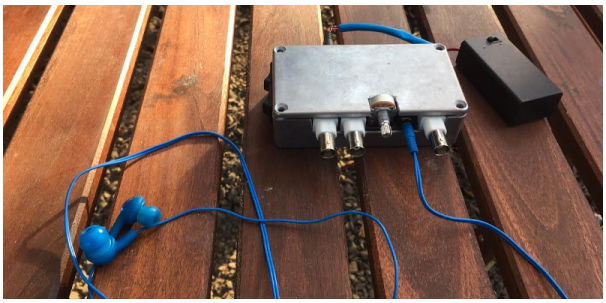
He gave me permission to work from his schematic to design a new layout and make my own units. I am releasing all of my documents and process under the CERN Open Hardware License v1.2.

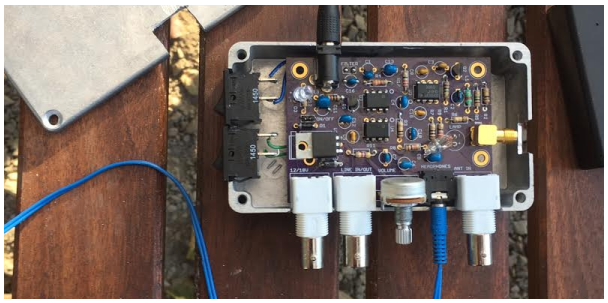
Here's the original E202 full-size schematic.

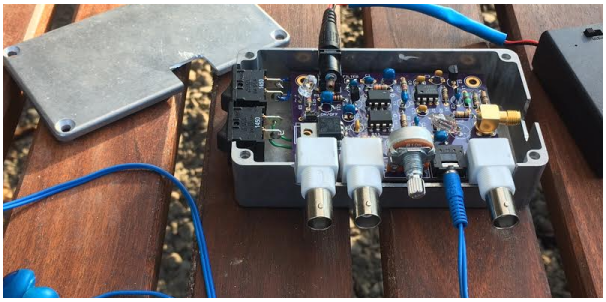
Version 1.1

For version 1.1, I was able to solder all the components, place the board in the metal box, apply a 9V battery for power, turn on the blue LED, and verify the basics of the operation.

The volume knob, filter and power switches, and headphone jack all work correctly. I could hear the received sound in my headphones and it changed pitch and volume as I adjusted ground connections, turned the volume knob, and moved my hand around in the air over the box.







Version 1.3

I created versions 1.0 and 1.1 in Eagle. I conveted v1.2 to KiCad but encountered some issues.

I ordered v1.3 boards from OSH Park and should have them in hand by Tuesday, January 3.

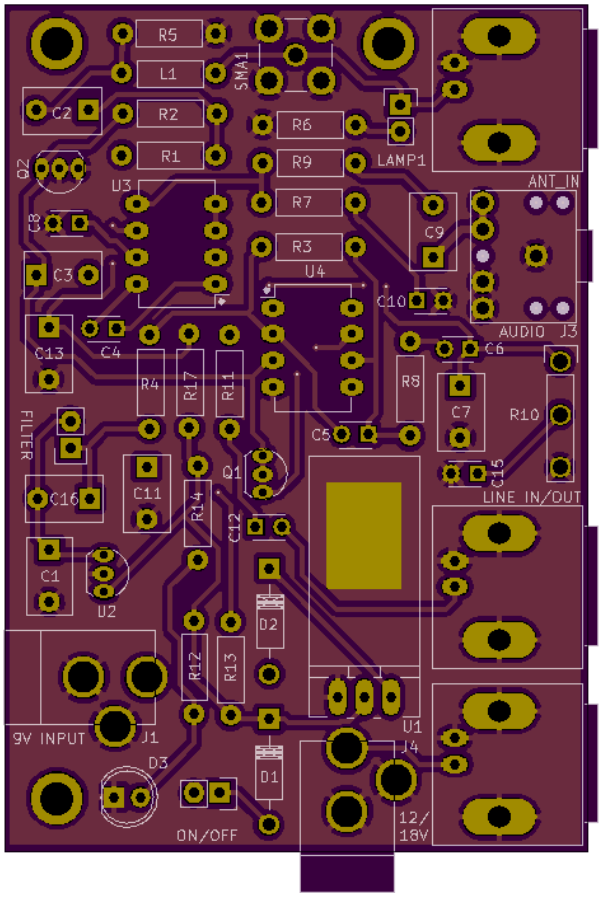
Bill of Materials

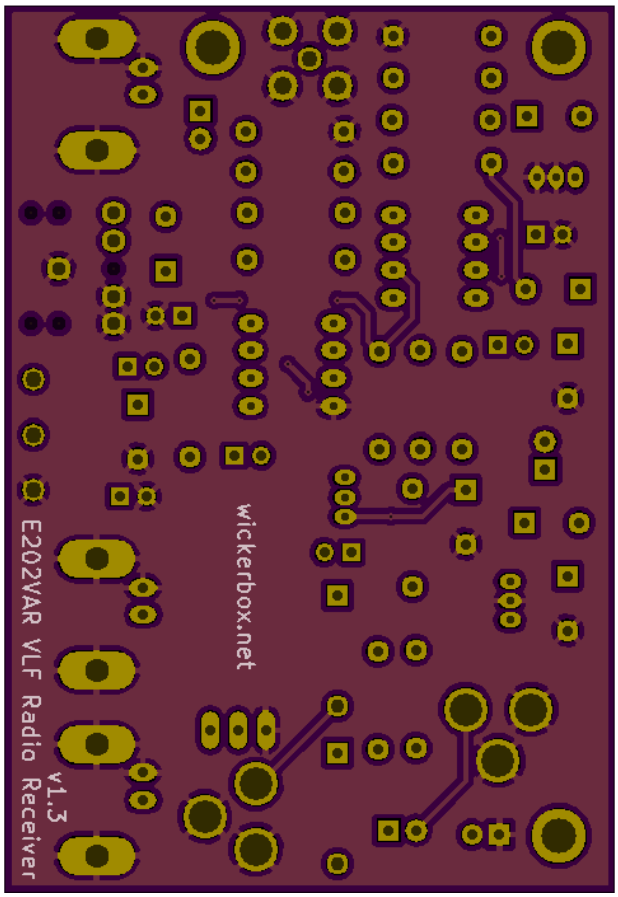
Total cost of parts is about $25 if you order minimums. It's about $100 if you go to the next price break for most at qty=10, which is what I did since I'm prototyping, and what I recommend if you want to build two or more units.

Digikey cart: http://www.digikey.com/short/3rcdb9

Ref	Qty	Description	Digikey PN
BNC1 BNC2 BNC3	3	CONN BNC JACK R/A 50 OHM PCB	A97555-ND
C1	1	CAP CER 0.033UF 50V C0G RADIAL	445-8490-ND
C10	1	CAP CER 10000PF 50V C0G RADIAL	445-8384-ND
C16 C7	2	CAP CER 4700PF 50V C0G RADIAL	445-8585-ND
C2 C11	2	CAP CER 0.1UF 50V C0G RADIAL	445-8532-ND
C3	1	CAP CER 8.2PF 50V NP0 RADIAL	399-8923-ND
C5 C15 C8	3	CAP CER 150PF 50V NP0 RADIAL	BC1015CT-ND
C6 C12 C4	3	CAP CER 10UF 16V X5R RADIAL	445-8290-ND
C9 C13	2	CAP CER 100UF 6.3V X5R RADIAL	445-8441-ND
D1 D2	2	DIODE GEN PURP 50V 1A DO41	1N4001-TPMSCT-ND
D3	1	LED BLUE CLEAR 5MM ROUND T/H	C503B-BCS-CV0Z0461-ND
J1 J4	2	CONN PWR JACK 2.5X5.5MM HIGH CUR	PJ-202BH
J2 J5	2	CONN TERM SCREW GREEN 2.54MM 2POS TH	ED10561-ND
J3	1	CONN JACK STEREO R/A 3PIN 3.5MM	CP1-3523N-ND
L1	1	FIXED IND 3.3UH 575MA 300 MOHM	78F3R3J-RC-ND
LAMP1	1	LAMP NEON 6.2MM WIRE TERMINAL	A9A-ND
Q1 Q2	2	TRANS NPN 45V 0.1A TO-92	BC547BTACT-ND
R10	1	POT 10K OHM 1/5W PLASTIC LINEAR	987-1301-ND
R11	1	RES 4.7K OHM 1/4W 5% CF MINI	S4.7KQCT-ND
R12	1	RES 2.2K OHM 1/4W 5% CARBON FILM	CF14JT2K20CT-ND
R13	1	RES 1K OHM 1/4W 5% CF MINI	S1KQCT-ND
R4	1	RES 3.3K OHM 1/4W 5% CARBON FILM	CF14JT3K30CT-ND
R5 R1	2	RES 10M OHM 1/4W 5% CARBON FILM	CF14JT1M00CT-ND
R6 R2 R3	3	RES 100K OHM 1/4W 5% CARBON FILM	CF14JT100KCT-ND
R7	1	RES 10 OHM 1/4W 5% CARBON FILM	CF14JT10R0CT-ND
R8	1	RES 10K OHM 1/4W 5% CF MINI	S10KQCT-ND
R9 R17	2	RES 33 OHM 1/4W 5% CARBON FILM	CF14JT33R0CT-ND
SMA1	1	CONN SMA JACK R/A 50 OHM PCB	ARFX1232-ND
U1	1	IC REG LDO 9V 1A MC7809 TO220AB	MC7809CTGOS-ND
U2	1	IC VREF GND REF ADJ TO92	296-6549-5-ND
U3	1	IC AUDIO PWR AMP LOW VOLT 8-DIP	NJM386D-ND
U4	1	IC OPAMP JFET 3MHZ DIP8	296-7203-5-ND

Gerber Preview





Assembly Diagram