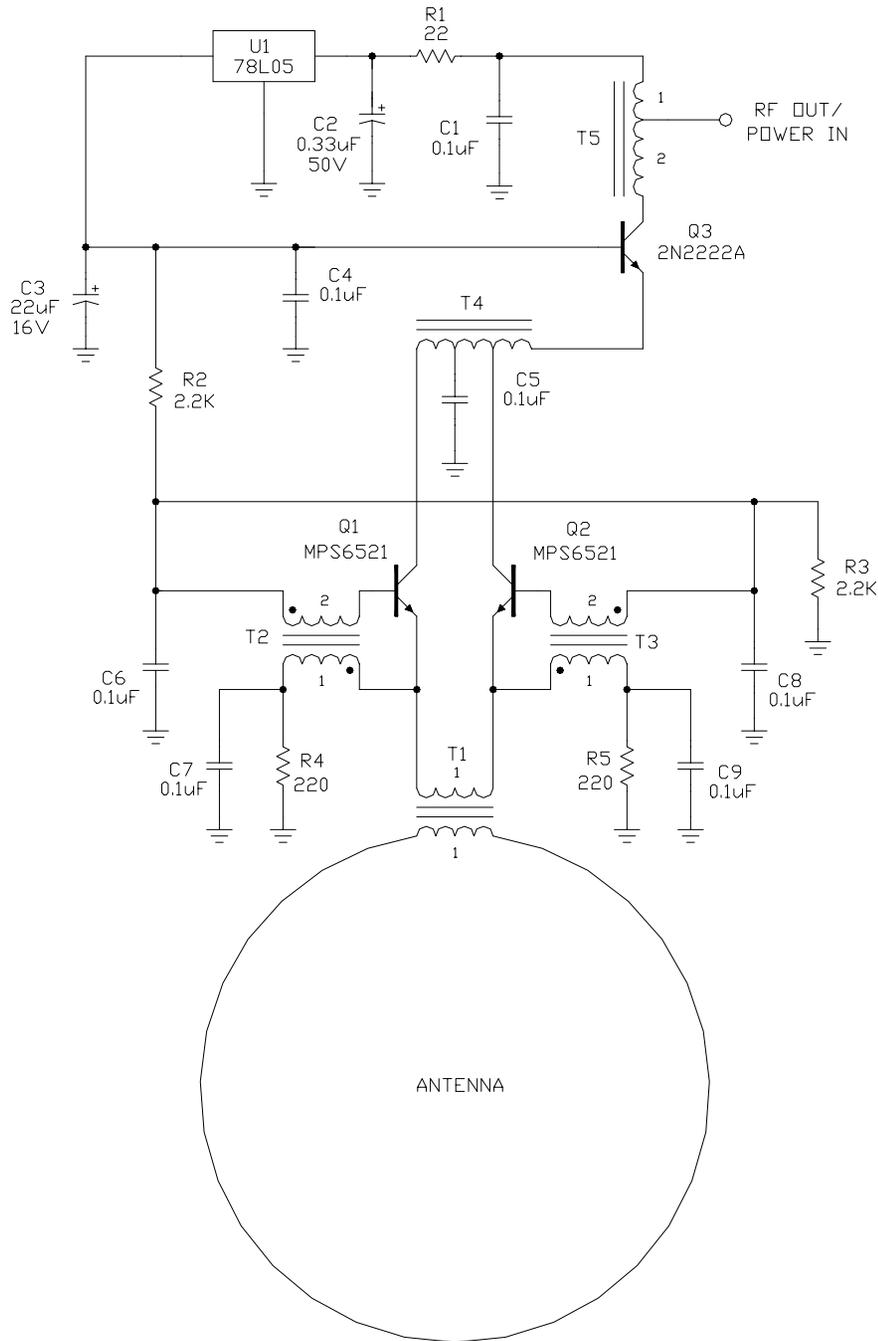
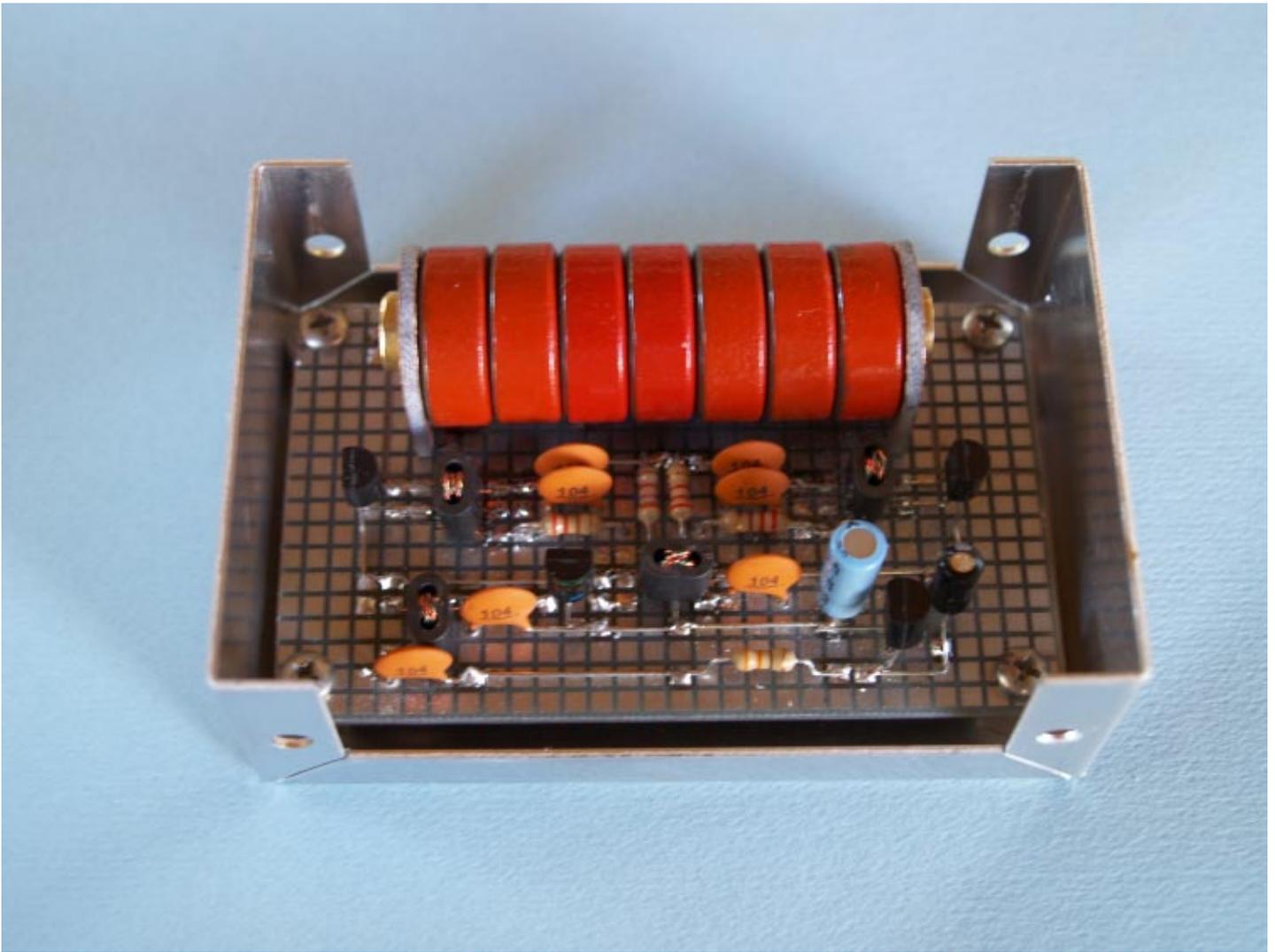


Wideband Active Loop Antenna Amplifier with Passive Augmentation

Transformer T1 is the inline transmission line current transformer, described on the next page. Transformers T2 and T3 are the augmentation transformers, T4 is the signal combiner balun, and T5 is the output autotransformer. The amplifier has a power gain of approximately 22dB





Wideband Loop Antenna Amplifier #1

This amplifier was designed to provide tuning-free wideband reception with a single turn loop antenna made with 1/4" copper tubing. The antenna is coupled to the amplifier by way of an inline 1:1 transmission line current transformer, which is the large red object at the top of the photo, and it is described later. The antenna element itself is not shown in this photo.

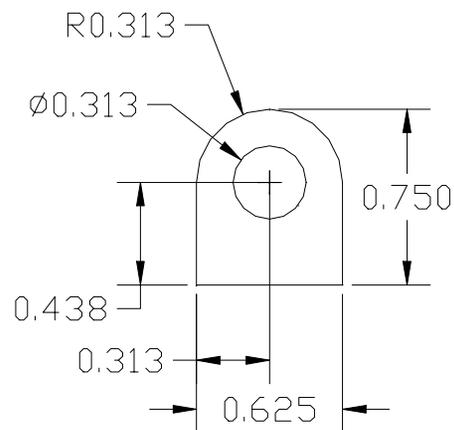
The amplifier is a balanced, augmented common base type having a very low input impedance, low noise figure, and exceptional intermodulation performance. Leaded components were used throughout for ease of construction. Supply voltage is 12V and is provided by way of the coaxial cable that goes to a bias tee and then the receiver. There is a PL259 male UHF connector on the back side.



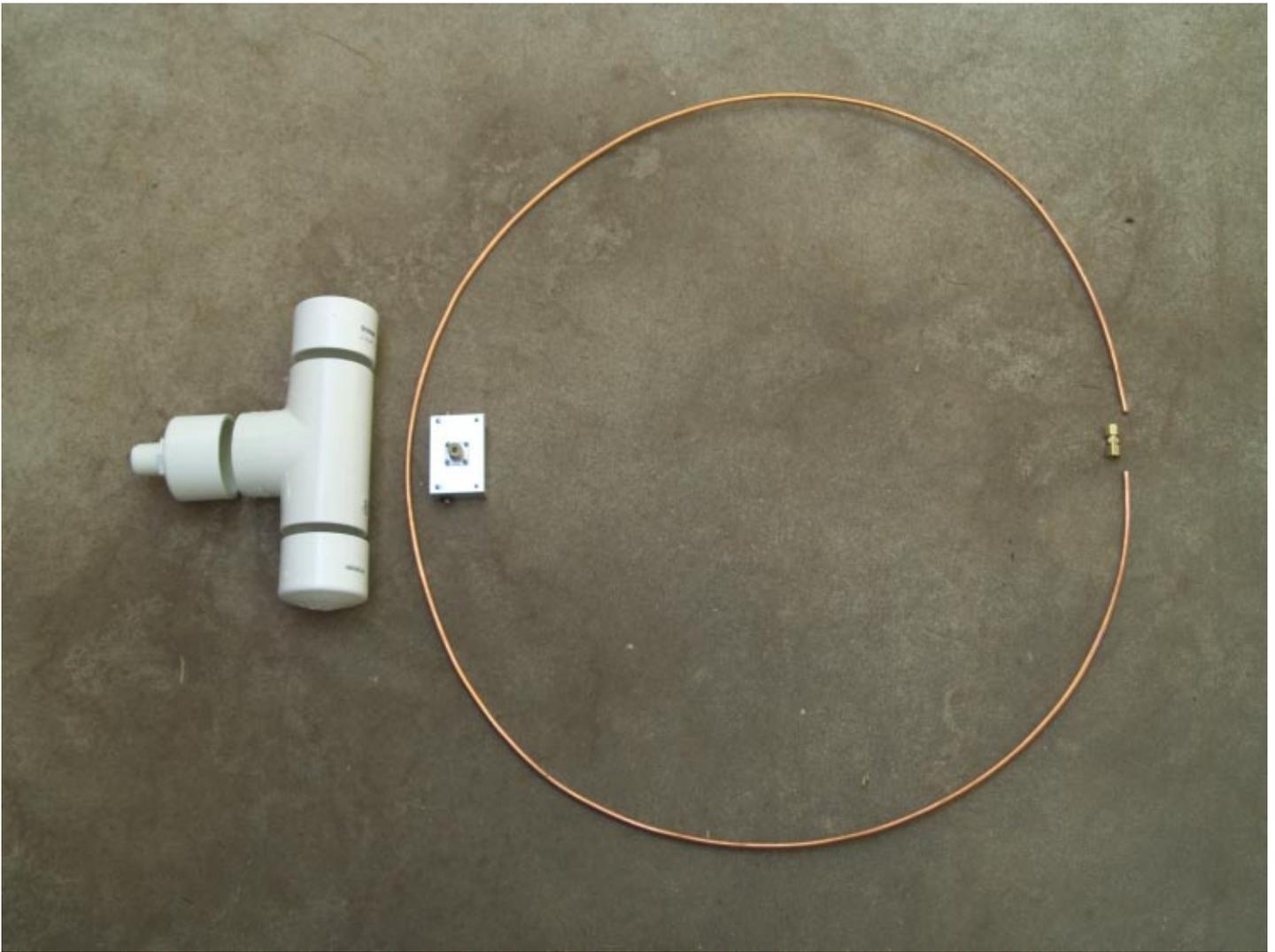
Inline 1:1 Transmission Line Current Transformer

The 1:1 inline transmission line current transformer is made to accommodate an antenna element made with 1/4" flexible copper tubing. A single layer of PVC heat shrink tubing is added to the portion of the antenna that passes through the transformer. The outer conductor of the transformer is made with 5/16" brass tubing, and the resulting coaxial transmission line has a characteristic impedance of approximately 3.5 ohms. Micrometals T68-2 toroids are used for the ferromagnetic material here, but a Fair-Rite 2643625202 ferrite sleeve will be used later. The endplates were fashioned from FR-4 PC board material using a drill press, file, and sandpaper.

Transformer End Plate
Material: 0.063" PC Board



A 2 1/4" long piece of 5/16" thin walled brass tubing is passed through the ferrite sleeve and then soldered to the end plates.



Wideband Loop Antenna Amplifier #1 Mechanicals

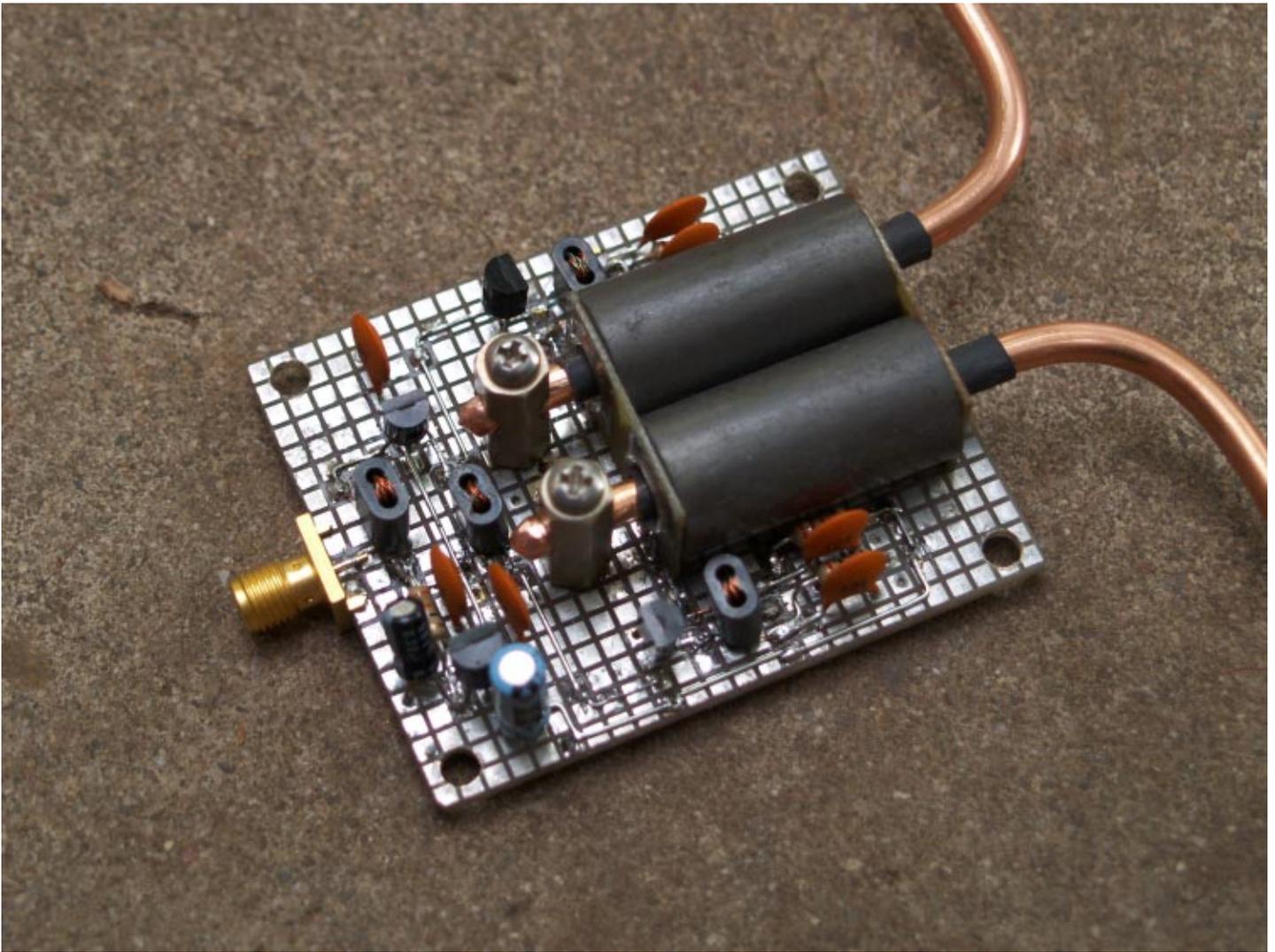
This version of amplifier is intended to be mounted in a 2 1/2" PVC Tee. The outermost 1" or more of the Tee is to be cut off, as is the better portion of the PVC end caps so as to make the assembly more compact. They are joined together using 1" long pieces of 2 1/2" PVC pipe (not shown).

The 1/4" copper tubing is cut to the desired length, then a 3" long piece of PVC heat shrink tubing is placed over the centre. The loop is then passed through the current transformer, then the assembly is placed into the Tee in the orientation shown. The end caps have 1/4" holes drilled in their centre, and they are passed over the ends of the loop and then fastened to the Tee using 1" long pieces of 2 1/2" PVC pipe (not shown).

A 1/4" to 1/4" compression fitting then joins the ends of the loop together, or they can be soldered using a short piece of brass tubing as a keeper.

Description	Mouser Part Number	Each	Qty	Cost
2N2222/PN2222 Transistor	512-PN2222TF	\$0.05	1	\$0.05
MPS6521 Transistor	512-MPS6521D26Z	\$0.09	2	\$0.18
LM78L05 Regulator	512-LM78L05ACZX	\$0.18	1	\$0.18
Resistors		\$0.04	5	\$0.20
0.1uF capacitors	140-50U5-104M-RC	\$0.10	6	\$0.60
0.33uF 50V Electrolytic	647-UVY1HR33MDD	\$0.07	1	\$0.07
22uF 25V Electrolytic	647-UVZ1E220MDD	\$0.07	1	\$0.07
Fair-Rite 2843002402 balun cores **		\$0.20	4	\$0.80
Fair-Rite 2643625202 Ferrite Sleeve **	623-2643625202	\$1.25	1	\$1.25
5/16" Brass Tubing		\$0.50	1	\$0.50
1/4" Flexible Copper Tubing		\$1.00	9	\$8.50
PC Board Material		\$0.10	1	\$0.10
Aluminum Enclosure	546-1411CU	\$4.08	1	\$4.08
PL259 Connector	523-83-1R	\$3.10	1	\$3.10
Vector Board		\$6.00	1	\$6.00
Miscellaneous Hardware		\$1.50	1	\$1.50
			TOTAL	\$27.18

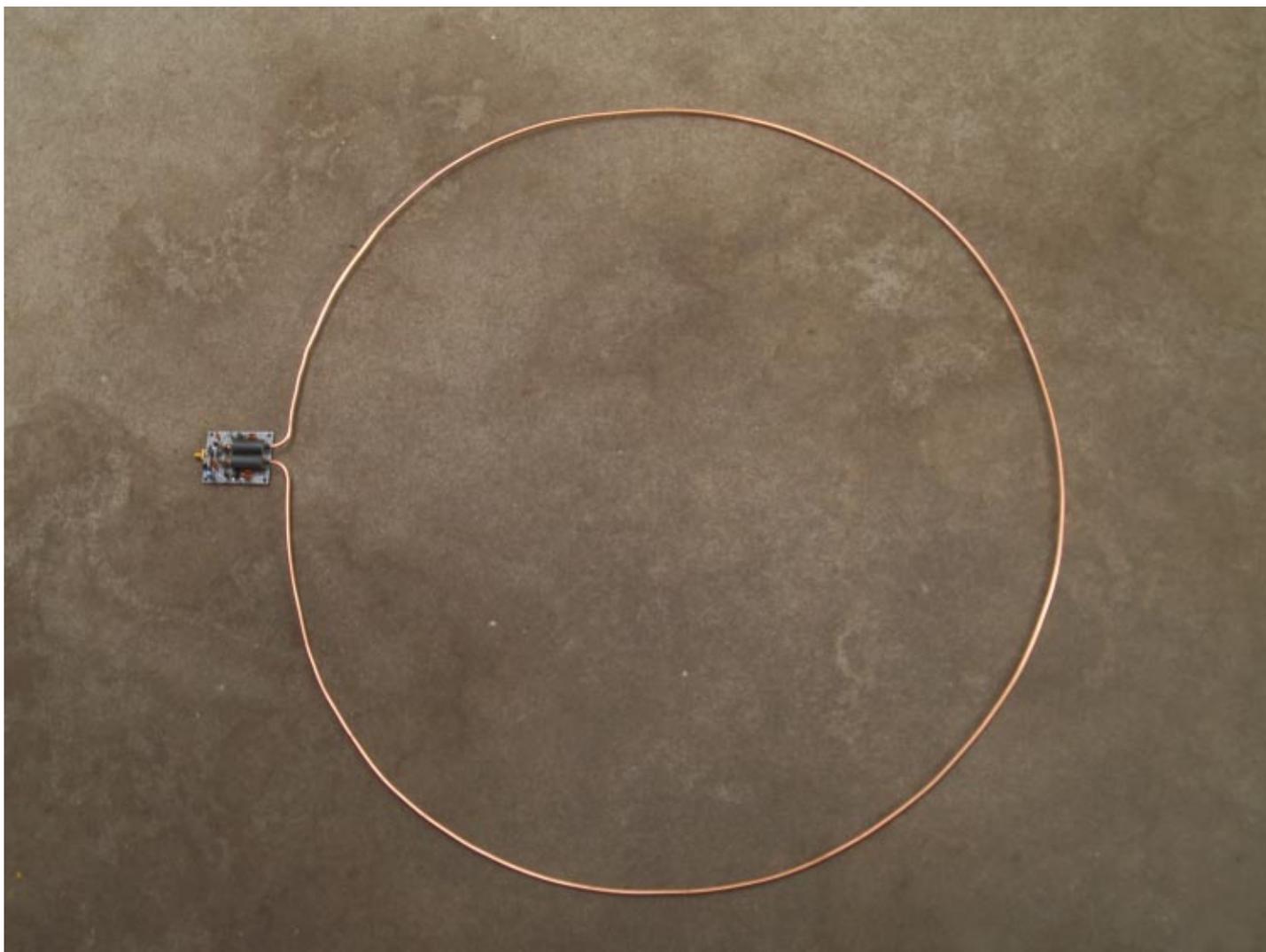
** - Can be purchased from Kreger Components (<http://www.kregercomponents.com>)



Wideband Loop Antenna Amplifier #2 (Transformer Modification)

This version of the amplifier was built using the Communications Concepts RF800-0 balun core. The loop itself is made from #6 AWG copper wire, with the ends bent as shown in the photo. A single layer of PVC heat shrink tubing over the ends of the loop provides the dielectric material needed to make a 1:1 balanced-to-balanced (BalBal) transformer having a characteristic impedance of about 5 ohms.

In this amplifier, 2N2222 transistors are used in place of the MPS6521 transistors of the earlier version. The IMD performance should be slightly better with these devices. Testing showed that there was no distortion of nearby strong BCB signals, which would have shown up in the 49M SWBC band.



The terminal posts for the loop are made from 1/2" long 4-40 aluminum or brass spacers. A 7/32" hole is drilled through at 3/8" from the one end. The posts are then mounted to the board using 3/8" long 4-40 screws with spring lockwashers. An additional pair of 3/8" long 4-40 screws are used for clamping the wire in place.

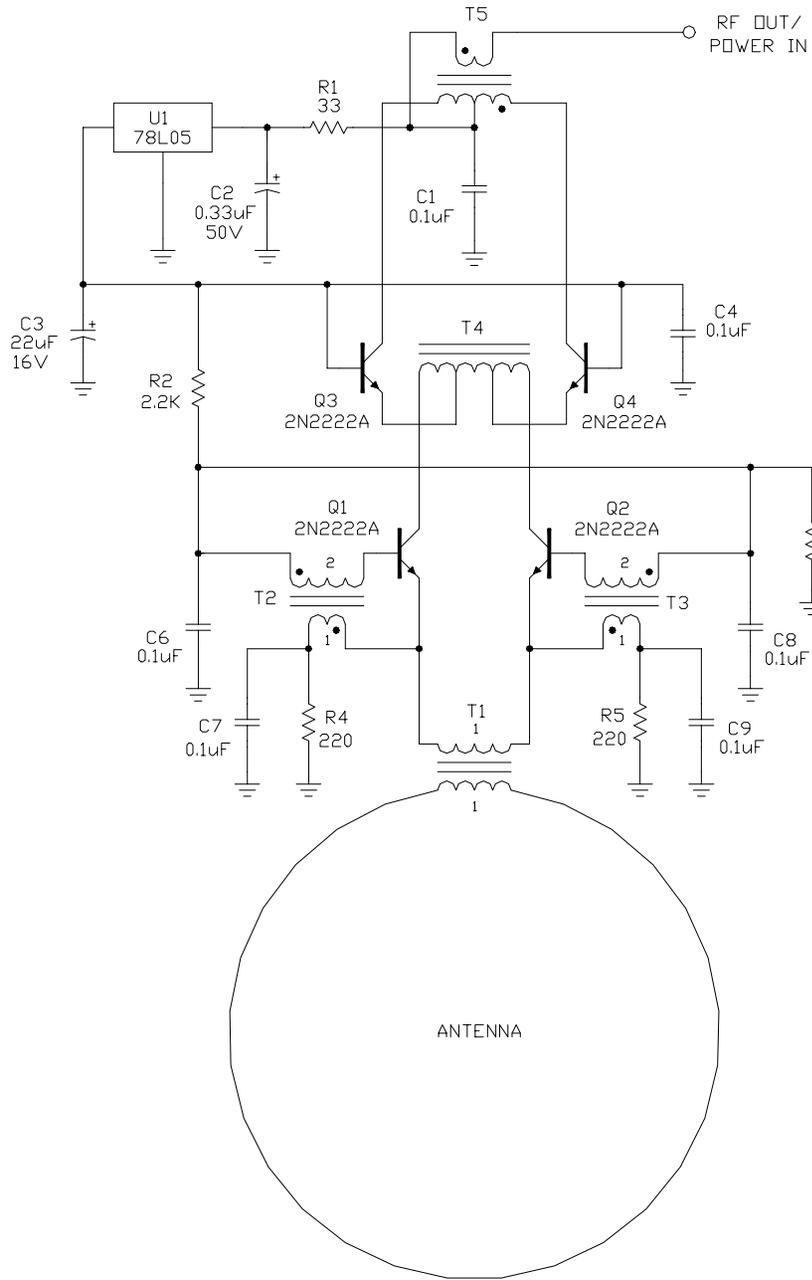
No enclosure is shown for this amplifier as I do not have a suitable aluminum box available. However, it will be machined such that the loop wires pass through grommet-protected holes at one end, and there will be a PL-259 male UHF connector on the other end

The loop itself, shown in the above photo, is 24 inches in diameter, or about 64 cm. It is intended for use in receiving MF and HF frequencies up to 18MHz,

Description	Mouser Part Number	Each	Qty	Cost
2N2222/PN2222 Transistor	512-PN2222TF	\$0.05	3	\$0.15
LM78L05 Regulator	512-LM78L05ACZX	\$0.18	1	\$0.18
Resistors		\$0.04	5	\$0.20
0.1uF capacitors	140-50U5-104M-RC	\$0.10	6	\$0.60
0.33uF 50V Electrolytic	647-UVY1HR33MDD	\$0.07	1	\$0.07
22uF 25V Electrolytic	647-UVZ1E220MDD	\$0.07	1	\$0.07
				\$0.00
Fair-Rite 2843002402 balun cores **		\$0.20	4	\$0.80
Communications Concepts RF800-0 Balun Core *		\$5.25	1	\$5.25
1/4" Flexible Copper Tubing		\$1.00	9	\$8.50
Aluminum Enclosure	546-1411CU	\$4.08	1	\$4.08
PL259 Connector	523-83-1R	\$3.10	1	\$3.10
Vector Board		\$6.00	1	\$6.00
1/2" long 4-40 Spacers	534-2203	\$0.42	2	\$0.84
Miscellaneous Hardware		\$1.50	1	\$1.50
			TOTAL	\$31.34

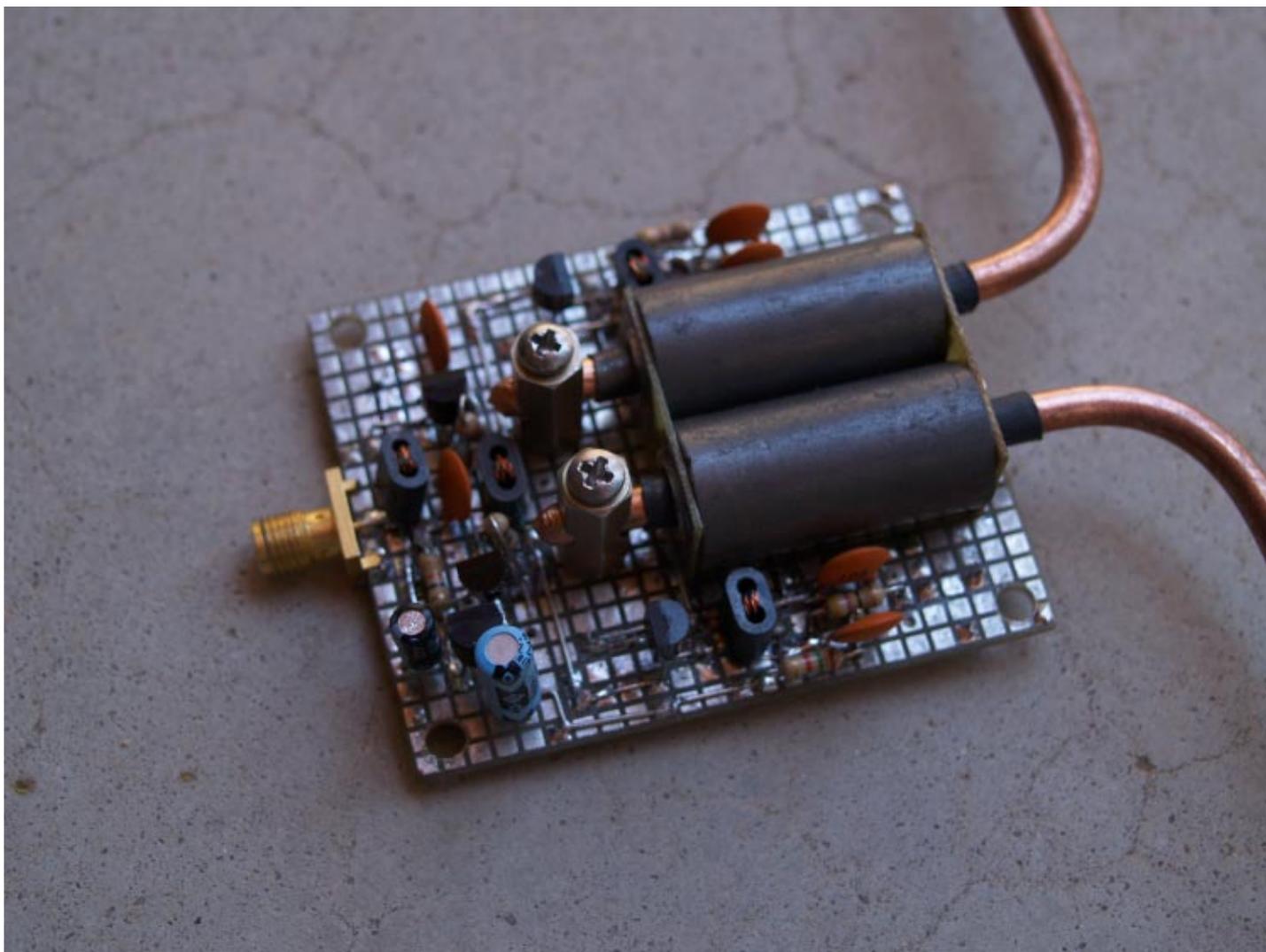
* - Can be purchased from Communications Concepts (<http://www.communication-concepts.com>)

** - Can be purchased from Kreger Components (<http://www.kregercomponents.com>)



Wideband Active Loop Antenna #3 (Gain Improvement)

Reconfiguring the interstage transformer T4 and the output transformer T5, plus the addition of one transistor yields a gain increase of 6dB.



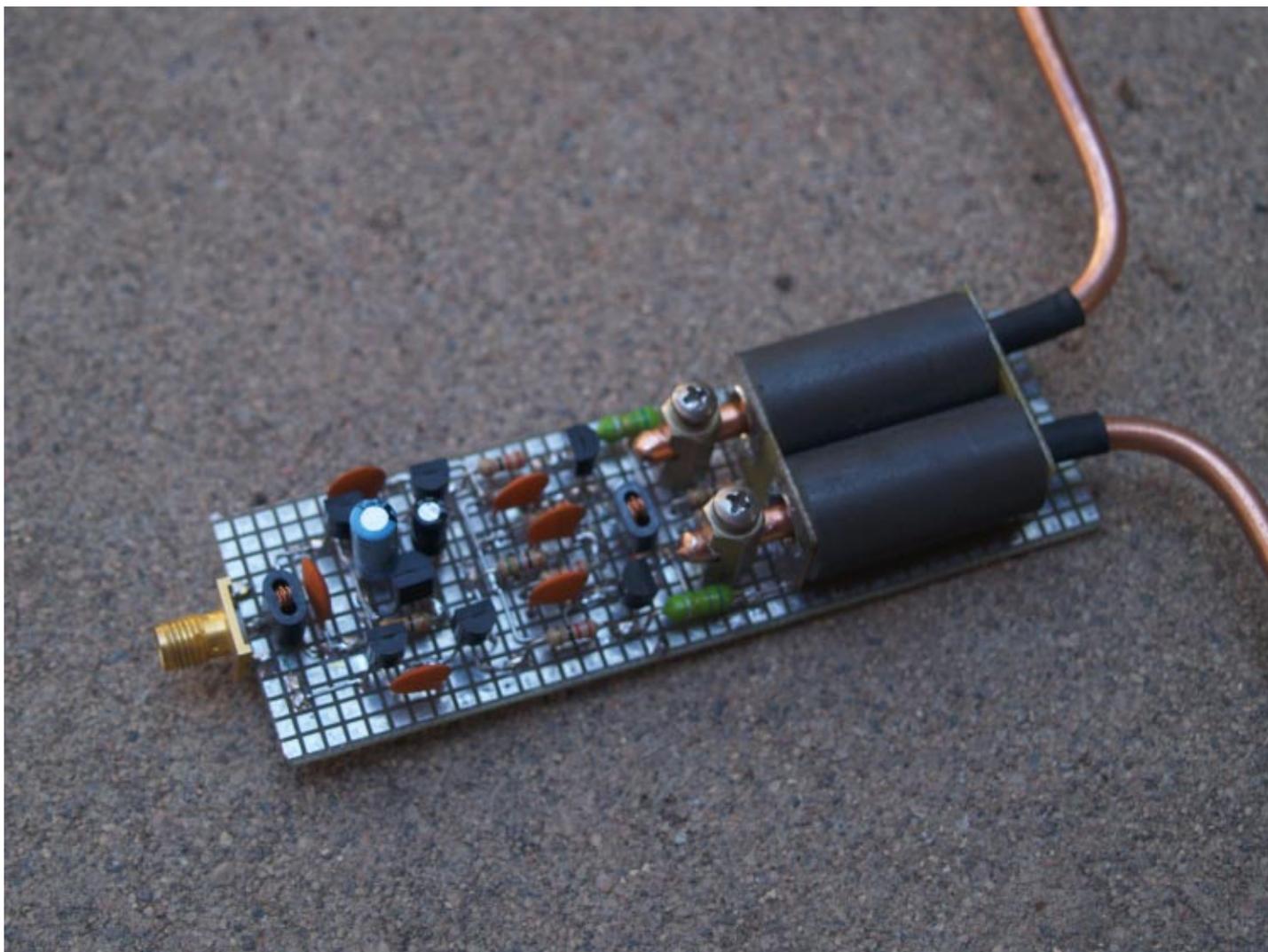
Wideband Loop Antenna Amplifier #3

Shown in the schematic of the previous page, this version of the amplifier has an additional transistor as well as reconfigured interstage and output transformers. All transformers in this design are 1:1:1 ratio, using 4 turns of #32 trifilar twisted wire on Fair-Rite 2843002402 binocular cores. For transformers T23 and T3, two of the windings are connected in series so as to attain the desired 2:1 turns ratio.

Description	Mouser Part Number	Each	Qty	Cost
2N2222/PN2222 Transistor	512-PN2222TF	\$0.05	4	\$0.20
LM78L05 Regulator	512-LM78L05ACZX	\$0.18	1	\$0.18
Resistors		\$0.04	5	\$0.20
0.1uF capacitors	140-50U5-104M-RC	\$0.10	6	\$0.60
0.33uF 50V Electrolytic	647-UVY1HR33MDD	\$0.07	1	\$0.07
22uF 25V Electrolytic	647-UVZ1E220MDD	\$0.07	1	\$0.07
Fair-Rite 2843002402 balun cores **		\$0.20	4	\$0.80
Communications Concepts RF800-0 Balun Core *	623-2643625202	\$5.25	1	\$5.25
*6 AWG Copper Wire		\$1.00	9	\$9.00
Aluminum Enclosure	546-1411CU	\$4.08	1	\$4.08
PL259 Connector	523-83-1R	\$3.10	1	\$3.10
Vector Board		\$6.00	1	\$6.00
5/8" long 4-40 Spacers	534-2203	\$0.42	2	\$0.84
Miscellaneous Hardware		\$1.50	1	\$1.50
			TOTAL	\$31.89

* - Can be purchased from Communications Concepts (<http://www.communication-concepts.com>)

** - Can be purchased from Kreger Components (<http://www.kregercomponents.com>)



Wideband Loop Antenna Construction Improvement

Based on the schematic of the previous page, this amplifier uses a much narrower PC board, which improves the overall mechanical aspects as shown on the following page. As shown on the following page, the base of the housing can now be made from 1 1/4" PVC pipe fittings instead of the earlier 2 1/2" size.

The amplifier shown in the above photo is an experimental design using active negative inductors for gain compensation. It did not perform very well due to excess noise, and no further details are available.

