

# Universal HF Receiver Kit

## Available Now

**This document describes the design and building of a Universal HF Receiver**

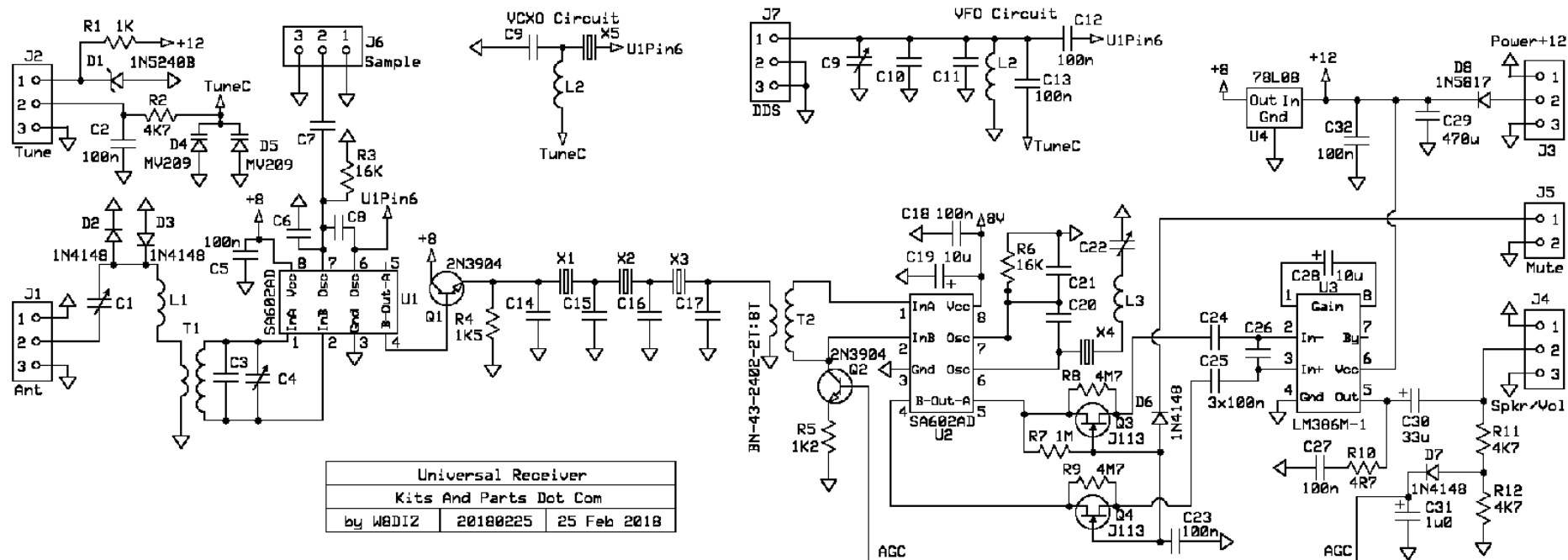
*Last Updated Sun, 01 Apr 2018 12:46:36 -0400*

*Always check the [Addendum Section](#) for updates before starting the kit build.*

### **Build this Universal Receiver for \$20**

**Plus Band Kits for \$10 each**

- Operate any frequency segment from 100 KHz to 30 MHz
- Dual conversion design with crystal filter selectivity
- Very low noise ( MDS -137 dBm )
- Tune using VCXO, VFO or DDS
- Optional Freq Counter with LCD Display PLJ-0802 (Available from Ebay)
- Printer Circuit Board Size: 1.2" (30,5 mm) x 3.8" (96,5 mm)
- VCXO Band Kits sold separately for \$10
- Audio Muting Kits sold separately for \$3
- Three (3) SMT ICs soldered to PCB \$3



[Click for Full Size Schematic in new window](#)

[Click for Full Size PCB layout in new window](#)

[Click to View Operational Prototype in new window](#)

[Click to View "Band Parts Table \(ODS\)" in new window](#)

[Click to View "Band Parts Table \(HTML\)" in new window](#)

Universal Receiver VCXO Band Kit Instructions for 10M 12M 15M 17M [20M](#) 30M 40M 80M 160M

Universal Receiver VFO Band Kit Instructions for 10M 12M 15M 17M [40M](#) 30M 40M 80M 160M

[Universal Receiver DDS Instructions](#)

[Mute Kit Instructions](#)

[Click to View "Theory of Operation" in new window](#)

## Base Kit Building Instructions:

**DO NOT REMOVE ANY PARTS FROM THE PLASTIC BAGS UNTIL INSTRUCTED TO DO SO**

[Parts List](#)

Do not mix up the red 1N4148 signal diodes with the red 1N5240B zener diode.

**If you are missing any parts, contact me immediately. I will ship the parts the same day.**

**If you find extra parts in the kit, check the Addendum else throw them in your junk box.**

This kit comes in 3 parts: Basic Receiver Kit, Band Kit and Mute Control Kit.

The Basic Receiver Kit and Band Kit contain all parts to create a fully functioning HF receiver.

Included parts are: 1 phone jack, a bnc jack, volume and tune controls and magnet wire.

Install the parts in the order per this document to prevent mechanical installation problems later.

This kit requires the following items to complete the kit:

Hook-up wire #22 or #24 gauge to connect the PCB to the controls and enclosure.

Rosin Solder 60/40 (OK) or 63/37 (Best) and a fine tip temperature controlled solder pencil.

Tool for adjusting trimmer capacitors - suggest search for GC-8608

Optional freq counter type PLJ-0802 - [search ebay 261731946045](#)

[Manual for PLJ-0802 Frequency Counter](#)

Optional power on/off switch.

Optional Case - [Suggested Cases](#)

### **1. Install all three (3) SMT ICs observing correct orientation**

\_\_\_\_ U1: SA602AD First Mixer IC  
\_\_\_\_ U2: SA602AD Second Mixer/BFO IC  
\_\_\_\_ U3: LM386-M1 Audio Amplifier IC

### **2. Install all 100n (0.1uF) green 2.5mm spacing capacitors **EXCEPT C12 & C13****

\_\_\_\_ C2,5,18,24,25,26,27,32

### **3. Install all 1/8 Watt Resistors **EXCEPT R3 & R6 & R12****

See NE602A spec sheet page 6 for more information about the

If you must install R6, note that it is installed vertical.

R12 is included in the MUTING Kit.

You may need a magnifying device to verify the resistor color codes.

Bend the resistor leads a sharp 90 degrees from the body of the resistors.

R13 and R14, the volume control and tune control will be connected later.

Save 6 cut resistor leads to ground the crystal cases later and other needs.

\_\_\_\_ R1: 1K Brown-Black-Red-Gold  
\_\_\_\_ R2,11: 4K7 (4.7K) Yellow-Violet-Red-Gold  
\_\_\_\_ R4: 1K5 (1.5K) Brown-Green-Red-Gold  
\_\_\_\_ R5: 1K2 (1.2K) Brown-Red-Red-Gold  
\_\_\_\_ R10: 4R7 (4.7) Yellow-Violet-Gold-Gold

### **4. Install three (3) Yellow Trimmer Capacitors**

\_\_\_\_ C1,4,22 (optional C9 is Customer Supplied)

### **5. Install all Diodes observing correct orientation**

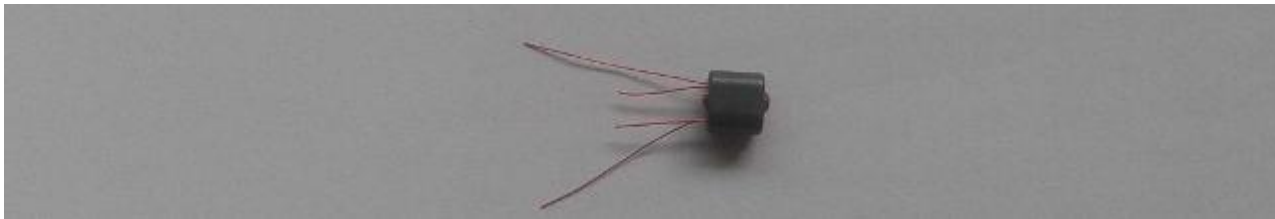
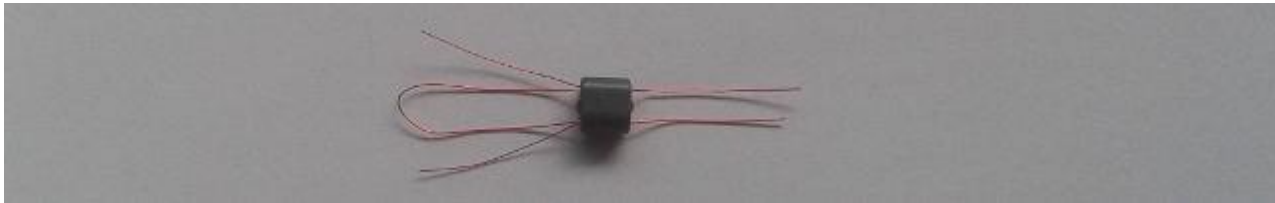
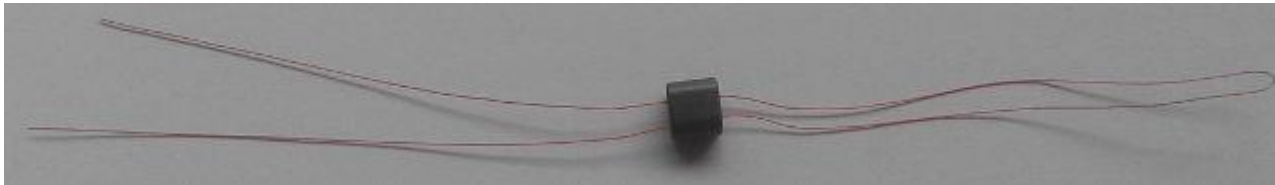
\_\_\_\_ D1: 1N5240B Red 10 V Zener

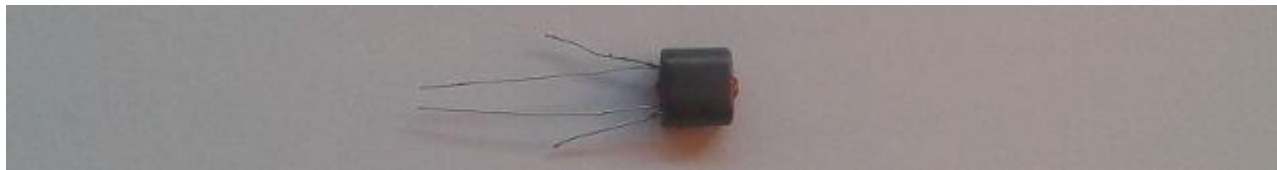
- \_\_\_D7: 1N4148 Red Signal Diode
- \_\_\_D8: 1N5817 Black rectifier Diode
- \_\_\_D4: MV209 Varactor Diode TO-92 (install 1/8 inch above the PCB floor)

## 6. Install transformer T2

Cut 10" of #34 red wire and 4" of #30 red wire.

- \_\_\_T2: Wind 8 turns of #34 red wire on an BN-43-2402 black ferrite binocular.





Trim the red wires of T2 to one inch each.

Wind 2 turns of #30 red wire on the BN-43-2402 black ferrite binocular.

Trim the #30 wires of T2 to one half inch each.

Strip & Tin the insulation on all 4 wires to the base of the binocular.

The #34 wire leads for the 8 Turn winding go to the two pads towards Q2.

The #30 wire leads for the 2 Turn winding go to the two pads towards C17.

Install T2 into the PCB, pull the leads tight using needle nose pliers, solder and trim.

#### **7. Install Transistors and the voltage regulator observing correct orientation**

\_\_\_\_ Q1: 2N3904 NPN Transistor

\_\_\_\_ Q2: 2N3904 NPN Transistor

\_\_\_\_ U4: 78L08 Voltage Regulator 8 volts

#### **8. Install all remaining Capacitors observing polarity orientation**

\_\_\_\_ C7: 10pF NPO Disc (NO NOT INSTALL C7 IF USING 40 METER BAND VFO KIT)

\_\_\_\_ C19,28: 10 uF Electrolytic

\_\_\_\_ C29: 470 uF Electrolytic

\_\_\_\_ C30: 33 uF Electrolytic

\_\_\_\_ C31: 1u0 uF (105) Yellow Cap




#### **9. Install 2 jumpers if not using the MUTE KIT**

\_\_\_\_ Jumper1: Use a cut resistor lead and install the jumper across R8

\_\_\_\_ Jumper2: Use a cut resistor lead and install the jumper across R9

## Notes:

Documentation on International [Radio Frequency Bands \(0-30 MHz\)](#)

Variable capacitor settings		
Maximum Capacitance	Midway Capacitance	Minimum Capacitance
		

If you need an alignment tool for the trimmer caps,  
look up "GC 8608" - available at [newark.com](#) and [onlinecomponents.com](#)

## Addendum Section:

March 14 2018 - On the PCB, D1 near J3 should be labeled D8 per the schematic.

March 29 2018 - On the PCB, C25 next to C29 should be labeled C28 per the schematic.

End of Addendum Section: [top](#)

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## 40 Meter Band VFO Kit (for Universal Receiver)

The parts in this VFO Kit are designed for 40 Meter CW reception from approximately 7006 to 7079 KHz  
The Kit includes the following parts/items:

L1 FT37-61 20T#27Green

L2 T50-7 44T#28Red

L3 FT37-61 20T#27Green

T1 T37-2 30T#30Red::4T#27Green

C3 100pF NPO

C6,8 220pF NPO

C7 47pF NPO

C10 470pF NPO

C11 180pF NPO

C14,15,16,17 470pF NPO

C20,21 120pF NPO

Crystals initially shipped starting March 27,2018 are

X1,2,3,4 Matched 5.0688 (filter center  $\pm$  5,068.9 KHz)

Crystals shipped after month day 2018 are

X1,2,3,4 Matched 5.0688 (filter center  $\pm$  5,067.4 KHz)

34 inches Green #27 magnet Wire

35 inches Red #28 magnet Wire

19 inches Red #30 magnet Wire

Install all the below parts in the order given.

\_\_\_\_C3: Install 100pF capacitor



\_\_\_\_\_C6,8: Install 22pF capacitors

\_\_\_\_\_C7: Install 47pF cap (marked 470) - used to feed Freq Counter

\_\_\_\_\_C10: Install 470pF cap (marked 471) - part of VFO tune circuit

\_\_\_\_\_C11: Install 181pF cap (marked 151) - part of VFO tune circuit

\_\_\_\_\_C14,15,16,17: Install 470pF capacitors - establish crystal filter bandwidth

\_\_\_\_\_C20,21: Install 120pF BFO capacitors; because of 0.1 inch lead spacing, install in the left and center holes

**Wind and install all Toroid Inductors. Wind all wires on the toroids [clockwise](#).**

\_\_\_\_\_T1: Install RF Bandpass Transformer.

Cut 19" of #30 red wire and tightly wind 30 turns on T1, a Red T37-2 toroid

Cut 6" of #27 green wire and wind 4 turns

Trim the #30 red wires to one inch.

Trim the #27 green wires to half inch.



Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install T1 with the #30 wires into the outside (upper and lower) holes on the PCB and the 3 or 4 turns #27 wire thru the center holes for T1.

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_L1: Install Series tuned Inductor

Cut 14" of #27 green wire and tightly wind 14 turns on L1, a black FT37-61 toroid

Trim the #27 green wire to one half inch.

Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install L1 on the PCB

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_L2: Install Main VFO Inductor

Cut 35" of #28 red wire and tightly wind 44 turns on L2, a red T37-2 toroid

Trim the #28 red wire to one half inch.  
Tin/solder the wire ends to the base of the toroid using a hot solder pencil.  
Spread the turns over most of the toroid.  
Install L2 on the PCB  
Pull the wires tight on the bottom of the PCB and solder, then trim.  
You should be able to straighten the toroid to match the outline on the PCB.

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#### L3: Install Series tuned BFO Inductor

Cut 14" of #27 green wire and tightly wind 14 turns on L1, a black FT37-61 toroid  
Trim the #27 green wire to one half inch.  
Tin/solder the wire ends to the base of the toroid using a hot solder pencil.  
Spread the turns over most of the toroid.  
Install L1 on the PCB  
Pull the wires tight on the bottom of the PCB and solder, then trim.  
You should be able to straighten the toroid to match the outline on the PCB.

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#### X1,2,3,4: Install 5.0688 MHz IF Crystals

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## 20 Meter Band VCXO Kit (for Universal Receiver)

The parts in this VCXO Kit are designed for 20 Meter reception from approximately 14039 to 14063 KHz.  
The Kit includes the following parts/items:

L1 FT37-61 14T#27Green  
L2 T37-2 34T#30Red

L3 FT37-61 15T#27Green  
T1 T37-2 30T#30Red::4T#27Green  
C20,21 120pF NPO  
C6,8 22pF NPO  
C14,15,16,17 680pF NPO  
X5 22.118 MHz VCXO Crystal  
X1,2,3,4 Matched 8.064 (filter center = 8,061.7 Khz)  
26 inches Green #27 magnet Wire  
40 inches Red #30 magnet Wire

Install all the below parts in the order given.

\_\_\_\_\_C6,8: Install 22pF VCXO Feedback Capacitors

\_\_\_\_\_C14,15,16,17: Install 680pF Capacitors - establish crystal filter bandwidth

\_\_\_\_\_C20,21: Install 120pF BFO Capacitors; because of 0.1 inch lead spacing, install in the left and center holes

**Wind and install all Toroid Inductors. Wind all wires on the toroids clockwise.**

\_\_\_\_\_T1: Install RF Bandpass Transformer.

Cut 19" of #30 red wire and tightly wind 30 turns on T1, a Red T37-2 toroid

Cut 6" of #27 green wire and wind 4 turns

Trim the #30 red wires to one inch.

Trim the #27 green wires to half inch.



Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install T1 with the #30 wires into the outside (upper and lower) holes on the PCB and the 3 or 4 turns #27 wire thru the center holes for T1.

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_L1: Install Series tuned Inductor

Cut 10" of #27 green wire and tightly wind 14 turns on L1, a black FT37-61 toroid

Trim the #27 green wire to one half inch.

Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install L1 on the PCB

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_L2: Install Series Tuned VCXO Inductor

Cut 20" of #30 red wire and tightly wind 34 turns on L2, a red T37-2 toroid

Trim the #30 red wire to one half inch.

Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install L2 on the PCB

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_L3: Install Series Tuned BFO Inductor

Cut 10" of #27 green wire and tightly wind 15 turns on L3, a black FT37-61 toroid

Trim the #27 green wire to one half inch.

Tin/solder the wire ends to the base of the toroid using a hot solder pencil.

Spread the turns over most of the toroid.

Install L3 on the PCB

Pull the wires tight on the bottom of the PCB and solder, then trim.

You should be able to straighten the toroid to match the outline on the PCB.

#### \_\_\_\_X5: Install 22.118 MHz VCXO Crystal

#### \_\_\_\_X1,2,3,4: Install 8.064 MHz IF Crystals

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