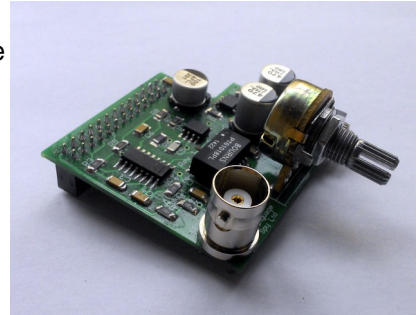


Pi-HF radio receiver kit instructions

1: Introduction

Thank you for purchasing a Pi-HF direct conversion HF receiver kit. This kit once assembled forms a simple yet effective radio receiver add-on for the Raspberry Pi for receiving amateur radio and other transmissions. It covers all the HF(shortwave) amateur and broadcast bands, as well as the medium wave (AM) and long wave broadcast bands. It is capable of receiving SSB and CW(Morse) transmissions, as well as AM broadcast stations with some reduction in quality. The Pi-HF is primarily for frequencies between 130kHz and 30MHz, however it has a bandwidth over 100MHz and so will also perform at higher frequencies including the 50MHz(6m) and 70MHz(4m) amateur bands. It is not a software-defined radio, instead it is a traditional radio receiver with software control.

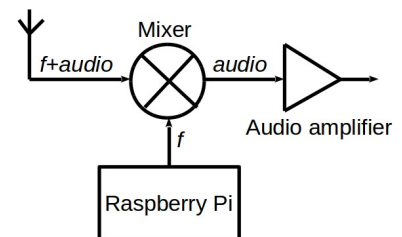


The Pi-HF uses many surface-mount components, which are soldered directly to the top of a circuit board rather than having wires pass through holes in the board and be soldered on the underside. Soldering surface mount components is not as easy as soldering through-hole components so this kit is not recommended for a complete novice solderer. Care has been taken to use surface mount devices that are not too small to work with and to place them with adequate space on the board, so this kit would be suitable for someone used to soldering through-hole who wishes to try a surface-mount kit.

All you will need to add to the kit once you've built it is a Raspberry Pi with appropriate software, an antenna, and a set of headphones to listen to the result.

1.1: How it works

The Pi-HF is a direct conversion receiver. This means that the radio frequency coming in from the antenna containing the audio that you want to hear is mixed with a plain signal on the same frequency generated by the Raspberry Pi's clock generator. The product of this mixture contains the frequency differences between the two, which are in the audio range because the two frequencies being mixed are so close together. These audio frequencies are filtered out and amplified for you to hear in your headphones.



2: Building your Pi-HF

2.1: You Will Need

A good light source. Surface-mount components are tiny, and easily lost. Plenty of light ensures you will be able to see them clearly. A good downward pointing desk lamp should suffice.

A clear high-contrast surface. Because surface-mount components can be difficult to see, it helps if they are manipulated over a bright white surface. A fresh sheet of white printer paper on a desk makes a suitable working area.

Good hands-free magnification. Unless you are fortunate enough to have amazing eyesight, you will need a good quality magnifier to work with surface-mount components. The "Helping hands" type on a stand is suitable, or perhaps the headband type.

A small flat-blade screwdriver. You will need to hold surface-mount components down while you solder them. If you have a set of jeweller's screwdrivers then usually one of the smaller ones will be suitable, below about 1.5mm in width.

A good-quality pair of precision tweezers. You will need these for picking up, manipulating, and turning over surface-mount devices. Metal tweezers are likely to be more useful than plastic ones, as they can be used on hot items during soldering.

A craft knife. Surface-mount components are packaged in a tape for use in automated board assembly machines. The tape has a thin plastic cover that needs to be carefully peeled back to reveal the components. This is best done over a well-lit surface under a magnifier using the tip of a craft knife. If the component falls out

of the packaging onto the floor or a badly lit surface it is unlikely that it would be found.

A fine-tipped soldering iron. With care this kit can be assembled with a standard fine tipped iron suitable for use with conventional 0.1" pitch through-hole components. However the size of surface-mount components means that you will require a greater level of skill to build it using the larger screwdriver style iron tips. Thus the finer the tip, the better for assembling this kit. It is also recommended that you use a temperature controlled iron at a suitable temperature for your solder, if you have one.

Lead-free solder, with a flux core. This is an RoHS and WEEE compliant product, so to maintain that compliance it should be soldered with RoHS lead-free solder. Any decent quality flux cored solder designed for electronic use should be suitable for assembling this kit. Solder intended for plumbing may not be suitable.

Flux. Any decent quality non-acidic soldering flux should be suitable for use with this kit. Use liquid flux in a syringe designed for surface-mount assembly if you can afford it, otherwise flux paste applied with a cotton bud.

Desoldering braid. Decent quality desoldering braid is a must for surface-mount work, as some of the techniques involve an excess of solder which must be removed. You may also find a set of side cutters useful, for cutting off used braid.

Solvent cleaner. This is not essential, but it is desirable to remove excess flux from your board when you have finished construction. Which solvent cleaners you have available will depend on where you are in the world, however a good electronic parts supplier should carry suitable products. We use an electronic-grade aerosol cleaner and an old toothbrush to scrub away the flux.

Finally, you should be aware of the possibility of damage to semiconductor devices from static electricity, and take care to use a suitable earthing arrangement if you think it may be necessary.

2.2: How to solder SMDs

It is assumed that anyone embarking on this kit will already be familiar with soldering through-hole components as it is not a kit for the novice solderer. Thus this "How to solder..." section will not deal with the through-hole components in this kit, instead concentrating only on the surface-mount elements.

Surface-mount construction differs from through-hole in that the components are not automatically held in place by a hole in the board. Thus surface-mount components face a hazard through-hole solderers may not be used to: they are subject to the forces exerted by the surface tension of liquid solder as it solidifies. A surface mount-resistor for instance will rise up on end, so-called "tomb stoning" as the solder solidifies if it is soldered at one end without being held in place. Techniques for hand surface-mount soldering therefore differ from those for through-hole soldering in that the emphasis is on securing the component as well as soldering it.

It is worth recommending here a YouTube search for videos of SMD soldering techniques.

2.2.1: Chip resistors and capacitors

Before soldering a chip resistor or capacitor, ensure that the pads it is to go on are clean, flat, and ready tinned. The board included in this kit is already tinned, however this step is included here as general advice for surface-mount soldering. If tinning a pad leaves a domed blob of solder on it, remove the blob with some desoldering braid and your soldering iron.

Apply a thin layer of flux to both pads.

Carefully peel back the plastic tape on the top of the tape containing the chip to release it. It is suggested you do this immediately above the area of board onto which it is to be soldered, it is easy to lose a loose a small component. If the chip has landed the wrong way up, turn it over with your tweezers.

Carefully nudge the chip into place with the tip of your small screwdriver so that its conductive ends are centred on the pads.

Place the tip of the screwdriver on top of the chip and apply gentle pressure to hold it down while it is soldered.

While holding down the chip, pick up a small amount of solder on the end of your soldering iron, and solder one end of the chip to its pad. When the solder has solidified, test that the chip is soldered to the board by giving the chip a nudge with the screwdriver.

Solder the other end of the chip. Use as little solder as you can and use as little contact with the iron as you can, you need to avoid melting the joint at the first end of the chip.

If your chip has a large blob of solder at each end, remove them with some desoldering braid. Capillary action will have drawn enough solder underneath the ends of the chip to make a good contact without the need for a blob of solder.

2.2.2: Larger surface-mount components

This kit includes some electrolytic capacitors which are much larger than the chip components, with much larger pads. Similar techniques are used to solder them, but they are much easier to handle and position.

As with the chip components, before soldering an electrolytic capacitor ensure that the pads it is to go on are clean, flat, and ready tinned.

Apply a thin layer of flux to both pads.

Peel back the plastic tape on the top of the tape containing the capacitor to release it. The electrolytic capacitors are large enough to pick up and place by hand.

Carefully place the capacitor on the board so that its connection tabs are centred on the pads. These components are polarised, so be sure to place them on the board the right way round. The angled corners should align with those on the outline printed on the board.

Hold the capacitor in place with the tip of your finger.

While holding down the capacitor, pick up a small amount of solder on the end of your soldering iron, and solder one tab to its pad. When the solder has solidified, test that the capacitor is soldered to the board by giving it a gentle push with your finger.

Solder the other tab. If the capacitor has a large blob of solder at each end, remove them with some desoldering braid.

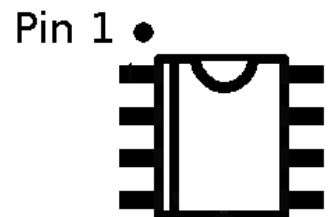
2.2.3: Integrated circuits and similar components

This kit contains three integrated circuits and an RF transformer, all of which have a similar outline with two rows of closely spaced pins. Soldering these pins individually would be a difficult task even for an extremely advanced solderer, so we will use a different technique of soldering multiple pins at once with an excess of solder which we will then remove with desoldering braid.

As with the chip components, before soldering an IC ensure that the pads it is to go on are clean, flat, and ready tinned.

Carefully peel back the plastic tape on the top of the tape containing the IC to release it. It is suggested you do this immediately above the area of board onto which it is to be soldered, it is easy to lose a loose small component. If the IC has landed the wrong way up, turn it over with your tweezers.

Gently nudge the IC into place with the tip of your small screwdriver so that its pins are centred on their pads. Take particular care to ensure that the IC is on the board the right way round. The ICs used in this kit have one bevelled edge on top, with the IC the right way up and the bevelled edge on the left pin 1 will be at the top left. The bevelled edge is marked on the board as a white line down the left hand side of the IC space, in addition pin 1 is marked with a white dot and a white semicircle to represent the notch found at the top of older dual-in-line ICs. Pin 1 of the RF transformer is indicated by a white dot on the top of the transformer, and a corresponding white dot on the board.



Place the tip of the screwdriver on top of the IC and apply gentle pressure to hold it down while it is soldered. Take care to keep it steady so that its pins do not move off their pads.

While holding down the IC, pick up a small amount of solder on the end of your soldering iron, and solder one corner of the IC to its pads. It does not matter if you cover a couple of pins with a blob of solder, the aim is merely to fix it down at this point. When the solder has solidified, test that the IC is soldered to the board by giving it a gentle nudge with the screwdriver. Inspect the IC to ensure that its pins are still correctly aligned with their pads. If it has moved you will need to very carefully melt the solder you have just applied and nudge the IC into place with your screwdriver.

Apply a thin layer of flux to each row of pins.

Solder the other side of the IC from that whose corner you have just soldered. Your aim is to hold a blob of molten solder on the end of your iron and run it down the row of pins in one fluid movement. Starting at one end melting the end of your solder wire over the IC pins you should be able to draw the resulting molten solder across the row. The flux will ensure that a good joint is made, and any surplus solder or solder bridges between pins will be later removed with desoldering braid.

Solder the first side of the IC in the same way as above.

Your IC should now be securely fixed to the board, but will certainly have an excess of solder and will probably have some solder bridges between pins. Carefully remove this excess with desoldering braid. Capillary action will have drawn enough solder underneath the IC pins to make a good contact without the need for a blob of solder.

2.2.4: After soldering

After soldering surface-mount devices using these techniques it is quite likely your board will be rather a mess with a lot of surplus flux on its surface. When you have completed all the surface mount soldering it is therefore worth removing all this flux with solvent cleaner. It won't stop the kit from working, but it looks unsightly.

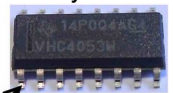
2.3 Construction details

2.3.1: Identifying the components

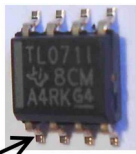
The larger through-hole components such as the connectors and volume control should be easy to identify. The surface-mount passive components will all be supplied in tape packaging with their value written on the tape to help identify them. Some of them will look identical to others with different values when they are out of their packaging, this section should help you tell them apart.

Integrated circuits. There are three ICs supplied with this kit. All are in SOIC (Small Outline Integrated Circuit) packages and have part numbers etched on top. Their tops have a bevelled edge along the row of pins containing pin 1, with the bevelled edge facing you pin 1 will be on the leftmost end of the row in front of you.

IC1 is a 74VHC4053 analogue switch which serves as the Pi-HF's mixer. It is easy to identify because it is the only 16-pin SOIC in the kit. It is marked with a truncated part number: "VHC4053".

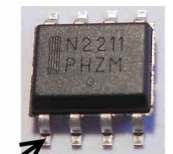


IC2 is a TL071 op-amp which serves as the Pi-HF's audio preamplifier. It is an 8-pin SOIC, and can be identified by its part number: "TL071".



Pin 1

IC3 is an NCS2211 audio power amplifier. It is an 8-pin SOIC and can be identified by a truncated part number: "N2211".



Pin 1

Wideband RF transformer. The wideband RF transformer has a black rectangular package about 12mm by 7mm by 6mm, with a row of 8 pins similar to those on the SOICs on each of its long sides. It can be identified by its part number: "PT61018PL".



Pin 1

Electrolytic capacitors. The electrolytic capacitors are all silver cylindrical cans with a plastic base and small connection tabs. They can be identified by their values in microfarads in the first line of writing on their tops: two marked "470" for C9 and C10, and one marked "100" for C1.

Chip resistors. The resistors are all "1206" size chips, 3.2mm x 1.6mm in size. They are black on top, with their value marked as a four-figure code, three figures and a multiplier to give the final value. It is recommended that you solder chip resistors to the board with the value on the visible side. One extra of each value have been included: small components are easy to lose. You should have 8 of 1k marked "1001", 3 of 10k marked "1002", and 2 of 220k marked "2203".

Chip capacitors. These are all "1206" size chips, 3.2mm x 1.6mm in size. They are a light brown or white colour and do not have a value written on them. Since they are very difficult to tell apart it is strongly recommended that you do not unpack more than one value at once. One extra of each value have been included: small components are easy to lose. You should have 2 of 100pF, 6 of 0.1uF, and 3 of 1uF.

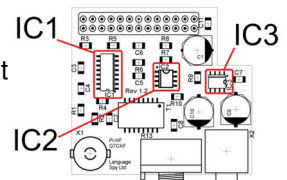
2.3.2: Pi-HF construction step-by-step

You should now be ready to build your Pi-HF. Here follows a step-by-step progression through the assembly process, in a recommended order. This order is not compulsory, however it has been chosen to ensure that smaller components are fitted before larger components that may make them difficult to reach for soldering.

It is **strongly recommended** that you only unpack one component at a time: that which you are currently installing.

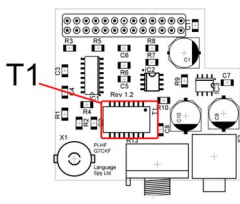
Step 1: ICs

First to be installed are the three ICs. Take care to identify pin 1, and to ensure that it is aligned with the end identified by the dot, the half-circle of the line printed on the board. The ICs are each in different alignments relative to the board. Take care to identify the different 8-pin ICs: IC2 is marked "TL071" while IC3 is marked "N2211".



Step 2: The wideband RF transformer T1

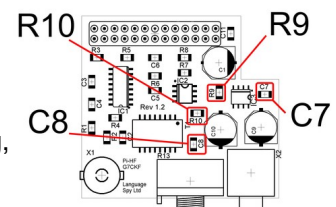
T1 should be soldered in the same way that you would solder an SOIC. Take care to ensure that its leads are in alignment with the pads, and that you have identified pin 1 by the white dot on the top of T1 and the white dot on the circuit board.



Step 3: R10, C8, R9, C7

R9 is a 10K chip resistor marked "1002", while R10 is a 1K chip resistor marked "1001".

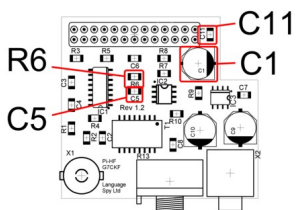
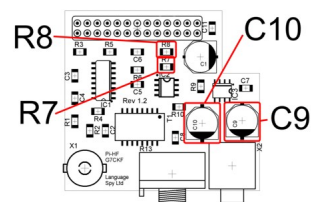
C7 and C8 are both 1 microfarad chip capacitors. They do not have any marking, so ensure that you have correctly identified them before you unpack them.



Step 4: R7, R8, C10, C9

R7 and R8 are both 1K chip resistors, marked "1001".

C10 and C9 are both 470 microfarad electrolytic capacitors. These components are polarised, so pay close attention to their alignment. The plastic base of each capacitor should match the screen print on the board, and the black half-circles on top of the capacitors should match those shown on the diagram.



Step 5: C11, C1, C5, R6

C11 is a 0.1 microfarad chip capacitor. It does not have any marking, so ensure that you have correctly identified it before you unpack it.

C1 is a 100 microfarad electrolytic capacitor. This component is polarised, so pay close attention to its alignment. The plastic base of the capacitor should match the screen print on the board, and the black half-circle on top of the capacitor should match that shown on the diagram.

C5 is a 100 picofarad chip capacitor. It does not have any marking, so ensure that you have correctly identified it before you unpack it.

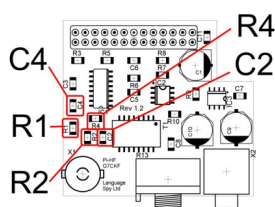
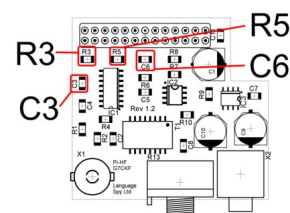
R6 is a 220K chip resistor, marked "2203".

Step 6: C6, R5, R3, C3

C6 and C3 are both 0.1 microfarad chip capacitors. They do not have any marking, so ensure that you have correctly identified them before you unpack them.

R5 is a 10K chip resistor, marked "1002".

R3 is a 1K chip resistor, marked "1001".



Step 7: C4, R4, C2, R2, R1

C4 and C2 are both 0.1 microfarad chip capacitors. They do not have any marking, so ensure that you have correctly identified them before you unpack them.

R1, R2, and R4 are all 1K chip resistors, marked "1001".

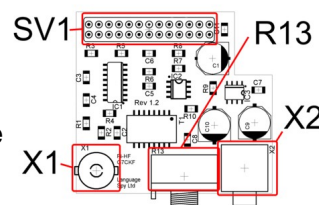
Step 8: Now would be a good time to remove any surplus flux with solvent cleaner.

Step 9: Through-hole components

The connectors and the volume control are all traditional through-hole components. It is recommended that you start with the Raspberry Pi connector SV1, which goes on the underside of the board with the pins being soldered on top of the board. Take care to ensure it is flush with the board at all points before soldering pins at opposite corners. If it is at a slight angle you can desolder one corner to fit it flush with the board. When it is fixed in place at the corners you can solder all the rest of the pins.

X2 and R13 should be straightforward to solder. Ensure R13 is not soldered at an angle. The BNC socket X1 will require a bit more heat than the other components to solder its earth pins, take care not to use too much solder.

If steps 1 to 9 above have gone according to plan, you should now have a completed Pi-HF. Congratulations!

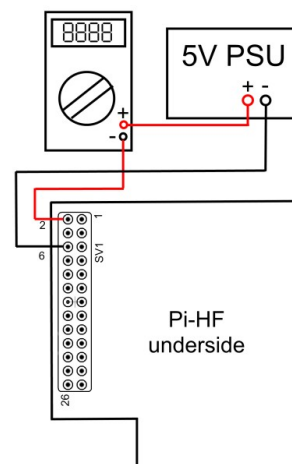


2.4 Before you plug it in

VERY IMPORTANT! Before you plug your completed Pi-HF into your Raspberry Pi, complete a close visual inspection of it under your magnifier. Pay close attention to any solder bridges that may remain between IC pins, across chip components or adjacent pads, the orientation of the ICs to ensure pin 1 is in the correct place, and the orientation of the electrolytic capacitors. Remove any surplus solder or solder bridges with desoldering braid.

If you have a 5 volt bench power supply and a multimeter that can measure current, you can measure the standing current consumed by the Pi-HF before you plug it into your Pi. Ensure the power supply voltage is exactly 5V, set the multimeter to a current range greater than 100mA, and plug a set of headphones into your Pi-HF. Now connect the power supply negative to pin 6 of SV1 and the positive via the multimeter to pin 2. A correctly assembled Pi-HF should consume about 15mA.

These steps are **very important** because your Pi can be damaged by short



circuits or other mishaps on your board. **If that happens it is your responsibility as the builder of the board.** It is better to have to rework or desolder something than to damage your Pi with your work.

3: Using your Pi-HF

The Pi-HF is designed to work with all Raspberry Pi models at the time of writing that have the first 26 pins of the GPIO connector and the clock generator GPCLK0 on pin 7. It has been tested on original Pi model A and B boards, B+ boards, and the Raspberry Pi 2. It will not plug into the Compute Module development board, nor is it guaranteed to work with Raspberry Pi compatible boards from organisations other than the Raspberry Pi Foundation.

3.1 First run

If you are happy that your Pi-HF is completed without solder bridges, does not consume too much standing current and has all parts correctly aligned, you are ready to go. Make sure your Raspberry Pi has its SD card and keyboard, mouse etc. but is disconnected from the power. **DO NOT plug or unplug your Pi-HF on the GPIO connector while your Pi is powered up.**

Now carefully plug the Pi-HF into the Pi's GPIO connector. If you have a Pi with the 40-pin GPIO connector such as the B+ or Pi 2, the Pi-HF should be plugged only into the first 26 pins that are compatible with the connector on older Pi boards. The Pi-HF has been designed such that it does not foul the components on any of the Pi circuit boards, however you should take a look for yourself to ensure that this is not happening. If necessary cut a piece of thin card to act as an insulator between the bottom of the Pi-HF and the Pi.

Connect a pair of headphones to X2, turn up R13 on the Pi-HF, and power up your Pi. If all is well your Pi should start as normal. If you are wearing the headphones and the volume control on the Pi-HF is turned up, you should hear some noises corresponding to the Pi going through its boot sequence. You should also be able to detect some noise – hiss – in the headphones, and if you touch your finger to R5 you should hear a mains hum.

To use the Pi-HF, all you now need is a suitable antenna, and some software.

3.2 Antennas

Antennas are a large enough topic to fill an encyclopedia alone, so their full description is beyond this document. However before directing you to search the web for suitable designs it is worth describing some simple antennas here to get you started.

The simplest antenna for a receiver like the Pi-HF is the random wire or longwire antenna, so-called because it is simply a piece of wire. It is not necessarily the best antenna for all purposes, but you can't beat it for ease of construction. Try about 5 metres of insulated wire connected to the centre terminal of the Pi-HF's BNC socket, and try to ensure that your length of wire is as high above the ground as possible. You can try longer lengths if you have them, which length gives best results will depend on your location and the frequency you are interested in.

If you are interested in one particular frequency you may prefer to try a dipole antenna. This is simply two quarter wavelength pieces of wire connected to the braid and centre respectively of a piece of co-axial cable connected to the Pi-HF's BNC socket. A wavelength in metres is 300 divided by the frequency in MHz, so for example a wavelength at 30MHz is 10 metres. Ensure that the two dipole wires go in opposite directions, and yet again ensure that the whole antenna is as high above the ground as possible.

There are many different antenna designs for you to try. Search the web for “swl antenna”, and you should find plenty of ideas.

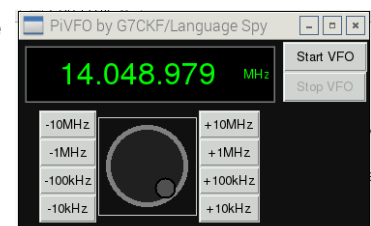
3.3 Software

The Pi-HF simply requires a piece of software that activates the GPCLK0 line and controls its frequency. We have produced PiVFO, a simple graphical front-end for a command line frequency generator called `freq_pi`. You can find both pieces of software on GitHub at the following address:

https://github.com/JennyList/LanguageSpy/tree/master/RaspberryPi/rt/freq_pi

Follow the instructions on the GitHub page to install, compile and run both packages on your Pi. You should install `freq_pi` first, then PiVFO. You will need to be able to type some commands on the Pi command line.

Once you have run PiVFO you can use your Pi-HF by clicking the “Start VFO” button and selecting a frequency. You will hear some noise when you use other Pi software and when you move the dial, this is the tiny amount of RF generated by the Pi's processor doing other tasks.



3.5 Listening with your Pi-HF

The Pi-HF is a capable receiver, but it is a simple device that can not match the performance of a much more expensive communication receiver in all ways. Therefore a quick introduction to listening with a wideband direct conversion receiver is in order to help you get the best from your Pi-HF.

There is no automatic gain control(AGC) on the Pi-HF. Therefore the volume of a station at the headphones is directly proportional to its strength at the antenna and a quiet signal will result in a quiet sound. The volume control R13 is included to reduce the volume of very strong stations, however for weak amateur stations you may find yourself listening with it set to maximum.

It is important to understand that there will not always be activity to listen to on any given frequency. Depending on the time of day or the atmospheric conditions, there may be no transmissions or the band may be “dead” due to poor propagation. You can always check your Pi-HF is working by tuning to a strong local AM station, and to get an idea of what HF bands are open you can search the internet for “HF propagation reports”.

As its name suggests the Pi-HF is designed primarily for the HF bands. It does however perform at higher frequencies up to about 100MHz, including the 4m and 6m amateur bands. For best results at VHF frequencies it is suggested that you use a narrow band antenna preamplifier for the band in question.

Because the Pi-HF is an inexpensive wideband design you may encounter spurious signals from very strong stations. For example in the UK you might sometimes hear a reduced-volume BBC Radio 5 Live on 909kHz if you tune to 303kHz, a third of its frequency.

Different transmission modes require different techniques with a direct conversion receiver. Here follows a guide to tuning the modes you may hear through your Pi-HF.

AM. The Pi-HF can receive AM transmissions such as broadcast stations. To receive an AM station tune the frequency to that of the station and you should hear a strong continuous tone with the station in the background. This is the Pi-HF oscillator mixing with the continuous carrier of the AM transmission. Simply adjust the Pi-HF frequency until the tone frequency drops to zero to hear the AM station. It is a function of a direct conversion receiver that music will not come through very well, however AM speech stations should be received quite acceptably. A good station to test this in the UK is BBC Radio 4, on 198kHz.

SSB and CW. These two modes do not have a separate carrier as AM does, so as you tune across them you should hear the tone of the speech or Morse change. Simply adjust the tuning until SSB is at an intelligible frequency, or until CW is at a comfortable tone for your taste.

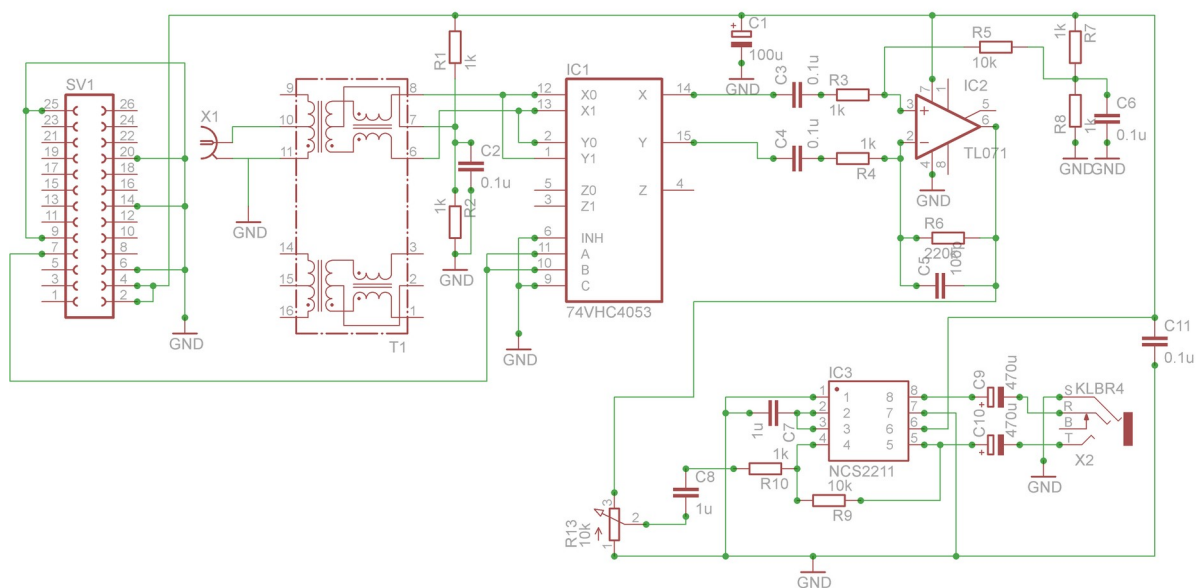
FM. The Pi-HF can not demodulate FM transmissions. However the FM broadcast band lies at the top end of its bandwidth, so while you can not hear what is being broadcast you can test operation at those frequencies by tuning to an FM broadcast station. You will hear noise rather than music or talk, but it will be obvious that there is a station on the frequency.

Appendix 1: Frequency charts

These are UK allocations, your territory may vary. For other bands try searching the web for frequency lists.

| Broadcast bands | Amateur bands |
|-----------------------------------|---|
| Long Wave: 153kHz - 279kHz | 2200m: 135.7kHz – 137.8kHz (Narrow band CW and digital modes) |
| Medium Wave(AM): 531kHz - 1611kHz | 600m: 472kHz - 479kHz (Narrow band CW and digital modes) |
| 120m: 2.3MHz – 3.4MHz | 160m: 1.81MHz – 2.0MHz |
| 90m: 3.2MHz – 3.4MHz | 80m: 3.5MHz – 3.8MHz |
| 75m: 3.9MHz – 4.0MHz | 60m: 5.2585MHz – 5.4065MHz (in a series of narrow channels) |
| 60m: 4.75MHz – 5.06MHz | 40m: 7.0MHz – 7.2MHz |
| 49m: 5.9MHz – 6.2MHz | 30m: 10.1MHz – 10.15MHz |
| 41m: 7.2MHz – 7.6MHz | 20m: 14.0MHz – 14.35MHz |
| 31m: 9.4MHz – 9.9MHz | 17m: 18.068MHz – 18.168MHz |
| 25m: 11.6MHz – 12.2MHz | 15m: 21.0MHz – 21.450MHz |
| 22m: 13.57MHz – 13.87MHz | 12m: 24.89MHz – 24.99MHz |
| 19m: 15.1MHz – 15.8MHz | 10m: 28.0MHz – 29.7MHz |
| 16m: 17.48MHz – 15.8MHz | 6m: 50MHz – 52MHz |
| 15m: 18.9MHz – 19.02MHz | 4m: 70MHz – 70.5MHz |
| 13m: 21.45MHz – 21.85MHz | |
| 11m: 25.6MHz – 26.1MHz | Other bands |
| | CB(11m): 26.965MHz – 27.99125MHz (SSB, AM and FM) |

Appendix 2: Circuit diagram



Appendix 3: Declaration of conformity

Organisation: Language Spy Ltd, Neve's Croft, Godington, Bicester, OX27 9AF, UK

Product description: The Pi-HF direct conversion radio receiver kit for the Raspberry Pi, a self-assembly kit of electronic parts.

This product has been designed to comply with the following directives:

Directive 2001/95/EC on general product safety

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment

As a piece of electronic equipment requiring less than 50V DC it is not applicable under article 1 of directive 2014/35/EU on low voltage.

As a self-assembly kit for use by radio amateurs it is exempt from the following directives under the following clauses:

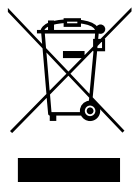
Annex 1 paragraph 1 of 2014/53/EU on radio & telecommunications equipment.

Article 1 paragraph 2(c) of 2004/108/EC on electromagnetic compatibility.

Article 2 paragraph 2(c) of 2014/30/EU on electromagnetic compatibility (When it becomes applicable).

Date: 2015-11-01

Jenny List, director



Raspberry Pi is a trademark of the Raspberry Pi Foundation.
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