Allstarlink HotSpotRadio Pi Hat Construction
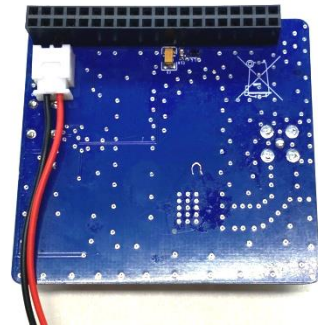
Note: We recommend using the stock antenna included on your unit. We have tested may antennas and the one we have included worked the best with the least amount of issues. Each brand and style of antenna has a slightly different RF radiation pattern. The HSR board is right next to the raspberry Pi board CPU. We observed some antennas have a RF radiation pattern that causes the raspberry Pi to lockup or to corrupt the MicroSD card, when transmitting.

If you need a higher gain antenna, please use an external antenna with a small run of feedline to move the radiated RF energy away from the HSR unit. We do have a limited number of these antenna available for purchase if you need one.

Construction

In this section is an example of how to install the Pi Hat HSR hardware onto your raspberry Pi 3B or Pi 3B+ board and make the necessary USB and ground connections from the Pi Hat HSR board to your raspberry pi board.

Verify that the USB data plug is plugged into the Pi Hat HSR board with the proper orientation as shown in this photo. Black wire the left side and Red wire to the right side.	
Thread the USB data cable (red and black wires) through the hole on the Pi 3B board next to the GPIO connector.	

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Measure and cut off excess leads on the black and red wires to solder to the USB data pads on the raspberry pi board as shown in the picture.

The best way to do this is to first apply solder to the TP45 and TP44 pads to form a nice ball of solder on the pad. Then strip and tin the red and black wires with very short leads. Reheat the solder and push the wire into the solder ball.

Solder the red wire to TP45 first, then solder the black wire to TP44 last.

If you have purchased the custom HSR C4Labs Pi case it is now time to construct and install the Pi 3 B board into the case. Refer to the installation instructions that are included with the case for assembly. Install only the large heat sink for the main raspberry Pi CPU. Leave the small heat sink installation on the bottom of the Pi until the very end of construction.

Leave the HSR Pi Hat board unplugged from the Pi GPIO header pings on the Pi 3B board to construct the case. This will make it easier to install and build up the case. Proceed through the included instructions to Item 9 and then stop.

Leave the two top levels of the C4Labs case off. Items 10 and 11
(The black housing level and the clear top cover that has the HSR logo)

Once the C4Labs case has been constructed with the raspberry Pi board installed you can plug in the HSR Pi Hat board. Make sure that the red and black wires do not get pinched in between HSR GPIO plug and the raspberry pi GPIO header pins.

You can now refer back to C4Labs instruction sheet for installation of Items 10 and 11. Proceed with installing Items 10 and 11, the black housing level and the clear top cover with the HSR logo. Lastly Install the small heat sink on the bottom of the Pi.

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The final step is to solder the black ground wire from the raspberry pi USB shield housing to the Pi Hat HSR board. Apply solder to the ground pad on the Pi Hat HSR board. (Location as shown in the picture.) Form a nice ball of solder on the pad. Measure then cut the black ground wire to length. Strip and tin the end of the black ground wire. Reheat the solder pad on the Pi Hat HSR board and push the ground wire into the solder pad.

Note: I use the hot solder iron tip to melt and create a channel for the black ground wire from the USB connector to the solder pad on the HSR board
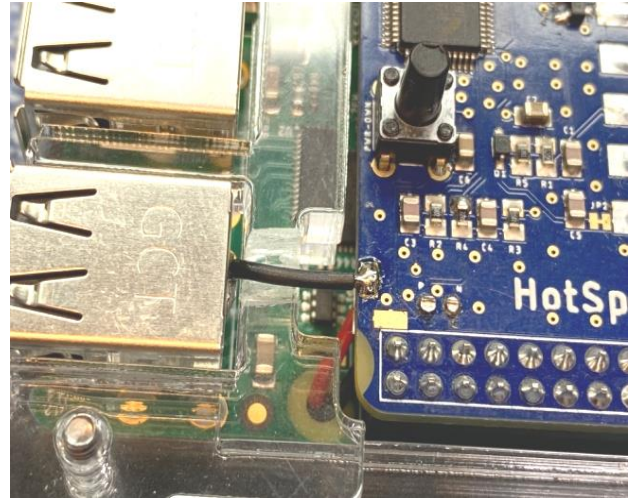
Insert the black USB filler plug supplied with the Pi Hat HSR board into the top right USB port. This is the USB port that is used internally by the HSR Pi Hat. (the red and black wires you soldered to the Pi 3B board). No other USB connection should be used on this specific port.

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Creating an Account with Allstarlink

If you have already created and account on Allstarlink website and have already a node number for your node you can skip to the **Node Configuration** section of this document in the middle of page 6.

Use your computer and a browser such as Chrome, go to allstarlink.org and click on the "Logon/Sign up" Tab. A small Allstar Account Logon screen will appear. Click on the "Sign Up" link at the bottom of this smaller screen.
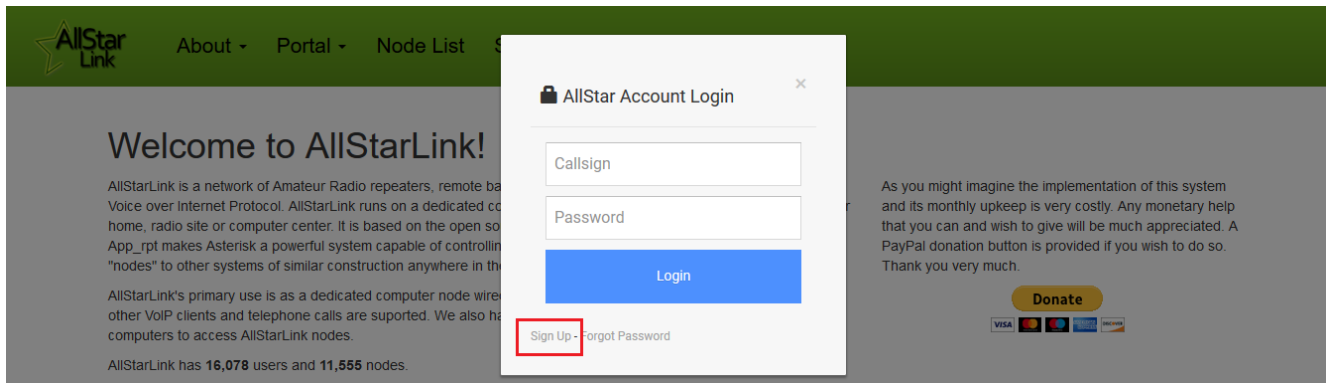
Read the information on the screen that appears and click on "Begin Registration."
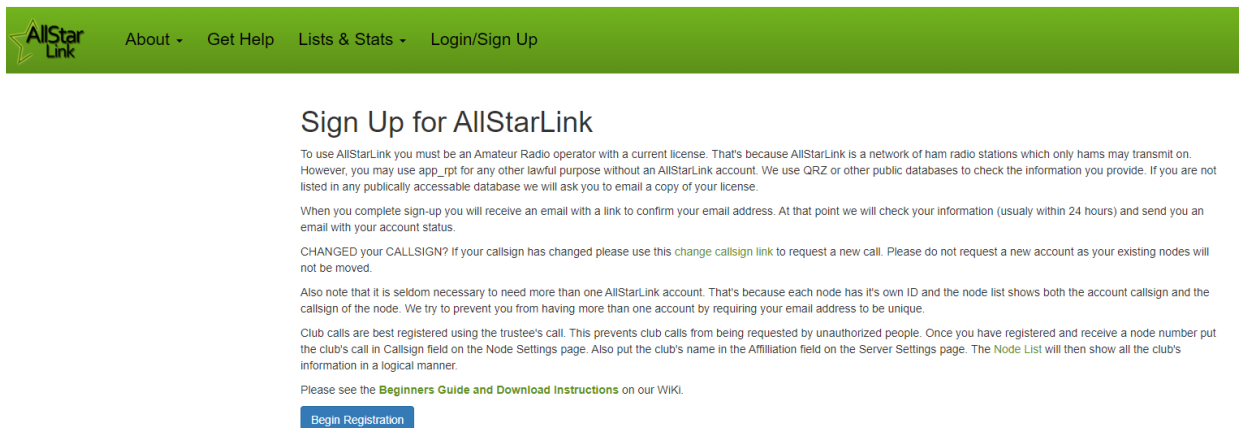
Fill in the form with your information and click "Submit.". It will take 1 to 24 hours to receive confirmation email.

You will receive a validation email to the email address that you used to create your Allstarlink page. You will need to click on the link in the email to validate your email address

so that your account can be validated. Check your email spam filter if you do not receive this validation email.

Creating a Server

Go to allstarlink.org web portal and logon with your callsign and password that you used to create your account.

First you need to create a server.

Click on the **Portal** tab. In the pull-down menu, click on Server Settings. Click on Proceed with **Server Setup.**

Fill in all the information:

Server Name - The server is your HSR *HotSpotRadio* node.
I like to use "HotSpotRadio" as the server name but you can call it whatever you like.

Server location – City, State is what most people use.

Affiliation - Optional entry.

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IAX Port - Leave this at **4569**

Proxp IP - Normally blank. Optional

Site – "Home," "Vehicle," Garage," are examples for the site field.

Note: Server Latitude and Longitude numbers will be automatically populated if you click on the Red pin on the map and drag it to the location of your server.

Once you have entered all your information in the fields you will need to click on the **Submit** button bellow the map.

Requesting a Node Number

Next you need to request a node number. This will be the node number you use for your *HotSpotRadio.*

Click on the **Portal** tab. In the pull-down menu, click on **Node Settings**.

Click on the **Request a new node number** link.

The next screen will prompt you to select the server to which the node is assigned. If you have only one server, the server you just created, it will appear in the selection box. If you have more than one server, the selection box is a drop-down selector. Select the appropriate server and click on the **Submit** button.

You can now logout of the AllstarLink.org web portal. (It will take 1 to 24 hours to receive confirmation email.)

Downloading the Image

You should download our customized HamVOIP zipped up image at the following location.

https://drive.google.com/file/d/1gFSnB0qBAhPt7ARiz5CVw9FDy3pPCGQJ/view?usp=sharing

This image has all the correct audio levels preconfigured along with the included software **"hotspot-prog"** to program the radio module on the *HotSpotRadio* unit.

There are also special settings in the cmdline.txt and config.txt files so that your Pi can program the SA818 radio module via the GPIO lines on the Pi.

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Node Configuration

Step 1

Prior to applying power to your node **make sure that you have installed an antenna on the Pi Hat HSR**. This will protect the radio module from transmitting without an antenna. Make sure your network cable is plugged into the *HotSpotRadio* unit.

When your node first boots up it will automatically transmit and announce the local IP address your node is using over the air. This feature lets you easily figure out what local IP address your node is using so you can login to your node via SHH on your local network for node configuration if you do not what to physically connect up a monitor and keyboard to the node raspberry pi.

Your Pi Hat HSR board has been programmed and tested before shipment to insure proper operation of the hardware. The radio module on the Pi Hat HSR has been programmed to the default simplex frequency of 439.000 MHz with a PL of 67.0 Hz.

1. The easiest way to set up your Pi is to use a monitor and keyboard connected to your Pi.

2. You may also connect to your Pi using an SSH connection over your network (hard wired) with Putty, WinSCP or MobaXterm software. (NOTE: you will need to know the IP address to your Pi.) We recommend MobaXterm. https://mobaxterm.mobatek.net/download.html select the free Home Addition.

3. The default username & password are both: **root**

4. Would you like to configure setup now: **YES**

5. Enter a New Root password (you can make this what you want, **DON'T FORGET IT**…)

6. Re-enter the root password for verification.

7. Do you want to set up your node: **YES**

8. Change Time Zone: change this timezone to your timezone. Select **NO** to leave the default timezone to Los Angeles. Select Yes to change your timezone. Cursor down to find your timezone, hit the spacebar to place a * in front of your selected timezone. Then select OK. 9. The current hostname is "alarmpi": This is the Pi's name and how it will be viewed on the network, you can change it or simply leave it.

10. IP: Most people leave this as Dynamic, but you can change it to Static if you choose.

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11. SSH: Most leave this as **222,** so simply select **NO**.

12. Reboot your Pi and log back in using root as the username and your new password.

13. You will see, This script configures Asterisk, Select **YES**.

14. Enter your node number: This will be the node number that you were issued by Allstarlink.org

15. Is this a private node? Since you have a node number that was supplied to you by Allstarlink.org , you will select **NO**, (this will be a public node.)

16. Enter station Call-Sign for your node: Enter the call-sign that was issued to you by the FCC. (or call-sign for the owner of this node.)

17. Pick either Voice or CW id. Voice: An audible voice will announce your call-sign or CW (morse code) ID of your call-sign will be played. We like the Voice ID, select. **YES**

18. Port 4569: (unless you have multiple servers running) Leave this as 4569 and select **OK**.

19. Duplex Mode: **Select 1** for a simplex node as your HSR Pi Hat is a simplex radio.

20. Node Password: Enter the node password that was supplied to you by Allstarlink.org, whichever node number you chose for this node you will need to use the password that was assigned for that node number.

(Note: again, this is the password that was issued for your specific node number and **not** the computer, #5 from above.)

21. IAXPRT: If you are ever planning on connecting to the system with your smartphone, then you would need to set up a password. Most people will not, so the answer to this is **NO**.

22. SimpleUSB: This configures your sound card adapter to work with your radio. You will not need to configure this as these settings have already be pre-configured in your image. Select **LATER**.

23. Restart? Select **YES**.

Since you are using this specific modified version of the HamVOIP image no audio levels or simpleusb configuration is needed as they have been preconfigured on the image.

TroubleShooting

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We have noticed certain antennas on the HotSpotRadio Pi Hat board will cause the Raspberry Pi board to reboot or act strange. This happens right after the Pi boots up and starts transmitting its IP address and callsign. This is caused by the specific RF radiation pattern of certain antennas. Remember the antenna port is very close to the Pi board. If you notice this issue. Remove the antenna and reboot the raspberry Pi and see if the reboot problem goes away. Do not operate the HotSpotRadio Pi Hat board without an antenna for more than a short time to test. You can also try using a different antenna.

Connecting your node to the network

You are now ready to use your node and connect. Using another radio that has a keypad. You will use the commands listed below to connect. (NOTE: You never use the radio connected to the Pi to enter commands, always use another radio.)

Let's try and connect to the 2000 HUB.

While holding down the PTT (Push-to-Talk) button, press the keys listed below.
The asterisk (*) enters the command mode.

Example: *32000 - This will connect you to the HUB 2000.

   a. *1(node number) - This Disconnects the node you are currently connected to..
   b. *2(node number) - This is Monitor mode only. You can listen, but will not be able to talk.
   c. *3(node number) - This will Connect you to the node you entered after the *3.

Again, if you would press and hold the PTT button in, and dial *3200 this will connect you to the 2000 HUB. If you want to disconnect from the 2000, you would press and hold the PTT and dial *12000.

Sometimes the Internet and/or the Network can have hiccups. Those hiccups can disconnect you from a HUB. You would just have to reconnect.

Permanently Connect:

You may find a time that you want to permanently connect to a specific node or HUB. This can also be done by entering a 7 before the command to connect or disconnecting. A Perk :-), if your node for whatever reason was disconnected from a HUB, this command will usually reconnect you automatically to the HUB you were previously connected to.

   a. *71 (node number) - Permanently disconnects you.
   b. *72 (node number) - Permanently puts you in monitor-only mode.
   c. *73(node number) - Permanently connects.

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Important Note:

Make sure that when you are changing to another Node/HUB or Room, that you **ALWAYS** disconnect from the Node/HUB or Room/ you were connected to before connecting to a different Node/HUB.

Additional (*) Commands:

*A1 Announce local IP address of your node.
*A3 Announce public IP address assigned to your node.
*A5 Announcce registration status of your node.
*A9 One time parrot mode. (*See Note Below)
*B6 Restart Asterisk
*80 Play local ID
*81 Play Time and Voice ID.
*82 Play local time in 24 Hour format

(* NOTE: The One Time Parrot mode will allow you to key up your mic, say something and it will repeat what you said, allowing you to hear what you sound like over the system. Each time you want to do this you need to enter the command before you speak. Example: Press and hold the PTT button, enter ***A9** and then speak your message. Then release the PTT button to hear the playback of your audio transmission.)

Ports:

The port to access your Pi using the Putty, WinSCP or MobaXterm software is **222**. (NOTE: the default in most programs is 22; Make sure to change this in your SSH program of choice.)

Asterisk uses port 4569 UDP for node communication and will need to be added to your internet router for incoming connections. No ports need to be added for outgoing connections.

Supermon, is a very useful tool and can be added to you HSR *HotSpotRadio* (the "Status Page") port 80 TCP, needs to be added to your internet router to view your Status Page if you choose to use it.

HotSpotRadio Status LEDs

Blue LED - (Upper right hand corner) Power to HSR board.

Orange LED - COR activity, when on the *HotSpotRadio* is receiving a signal

Green LED Flashing (USB Heartbeat - Sound chip is talking to software correctly)

Red LED - PTT when on the *HotSpotRadio* is transmitting

After construction of your node plug it into a network cable for internet access before applying power to the node. Note: Upon first powering up your node, it needs to report your node IP address to the registration servers. Then the registration servers will send your node IP address information to the rest of the nodes. This usually takes around 10-15 minutes for the process to be completed. During that time you will not be able to make any connections to other nodes.   Once your node has been

connected to the internet for 15 minutes, you will be able to make connections to other Allstar nodes.

Powering Down your *HotSpotRadio* Node

You can hold the power down button on the top of the node for 8 seconds. Your node will power down in about 20 seconds. If you have your radio on you will hear your *HotSpotRadio* node keyup and announce that it is powering down. Watch the red and green LEDs on the Raspberry Pi board which are located underneath the antenna on the actual Raspberry Pi board. (Do not confuse the Pi board LEDs with the *HotSpotRadio* status LEDs)

Once the Raspberry Pi has powered down the green LED on the raspberry Pi will no longer flash intermittently. The green LED is actually showing when information is being written to the Micro-SD card and you **NEVER** want to remove power from the raspberry pi when the Micro-SD card is being accessed as this can corrupt the Micro-SD card on your node.

When your node has powered down you will only see a steady solid red LED on the Raspberry Pi board. It is now safe to remove power from your Pi. I recommend removing the wall-wart from the AC outlet and not unplugging the micro-USB power connector from the Pi to power down your *HotSpotRadio* node. The micro-USB connector on the Raspberry Pi board is very fragile and you can easily wear out this connector or even break. It is just better practice to use the AC wall-wart to remove power as it will not wear out or break when removed many times from an AC outlet.

Programming Your Radio Module

The *HotSpotRadio c*an be programmed with frequency and CTCSS of your choice.
If you need to change this, it is very easy.

Login in to your *HotSpotRadio* with your favorite SHH program or connect up a keyboard and display to your node. Login as user root, then your password that you created when you configured your node.

After logging in you will be taken to a menu. Select item 9 Start Bash Shell Interface. This should take you to a prompt. The *HotSpotRadio* program is located if the following directory.
Type the following at the prompt to get to this directory

cd /usr/local/sbin/

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Once you are in the sbin directory you can open the program. Type the following.

Hotspot-prog

You should see the program open and it should look like the following.

```
-------------------------------------------------------
SA818-prog, Version 1.03

Programming HotSpotRadio PiHat / SA818(U/V) Module

Programming Device name:
      /dev/ttyAMA0
-------------------------------------------------------

What are you programming?
Enter 1 or 2 where HotSpotRadio PiHat=1, SA818 Module=2: 1

    Programming a HotSpotRadio PiHat
    Wide channel spacing

Enter band (VHF=1, UHF=2): 2
    You chose UHF

Enter transmit frequency in MHz (xxx.xxxx): 443.4000
    The transmit frequency is 443.4000 MHz

Enter receive frequency in MHz(xxx.xxxx): 443.4000
    The receive frequency is 443.4000 MHz
Do you want to use a sub audible tone? (0 = No, 1 = CTCSS, 2= DCS): 1
    You chose CTCSS

Enter Tx CTCSS Frequency in Hz(xxx.x): 100.0
    You entered 100.0 Hz
    The Tx CTCSS code is 0012

Enter Rx CTCSS Frequency in Hz(xxx.x): 100.0
    You entered 100.0 Hz
    The Rx CTCSS code is 0012

Enable Reverse Burst (y/[n]): y
    Reverse burst is enabled

Enter Squelch Value (1-9): 3
    Squelch is set to 3

Enter Volume (0-8): 8
    Volume is set to 8

Enable Pre/De-Emphasis (y/[n]): y
    Pre/De-emphasis is enabled
```

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```
Enable High Pass Filter (y/[n]): n
    High pass filter is not enabled

Enable Low Pass Filter (y/[n]): n
    Low pass filter is not enabled


Verify:
--------------------------------------------------------
    Channel Spacing: 1
       Tx Frequency: 443.4000
       Rx Frequency: 443.4000
       Tx CTCSS code: 0012
       Rx CTCSS code: 0012
 CTCSS Reverse Burst: y
       Squelch Value: 3
        Volume Value: 8
 PreEmphasis Enabled: y
   High Pass Enabled: n
    Low Pass Enabled: n
--------------------------------------------------------
Is this correct ([y]/n, or a to abort) ?y

Sending Freq Information...
Setting Volume - 8
Setting Reverse Burst
Setting Filters

Programming Successful

[root@yournodenumber asterisk]#
```
If your are successful you should see at the very end "Programming Successful"

Note: You must **<u>always enable Pre/De-Emphasis with a "Y"</u>** when programming or changing any or your radio parameters. You must **<u>always set the Volume at 8</u>** as well. This controls the receiver audio level to the Allstarlink network from your *HotSpotRadio* node.

If you have any questions regarding the *HotSpotRadio* hardware or configuration please join our mailing list at:

https://groups.io/g/*HotSpotRadio*s

Click on the subscribe link to join the group.

You can any questions that you may have. There are several folks on this group who can offer help to you.

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73

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