

NoBoB for Android User Guide

robo1340

robo1340@protonmail.com

November 2020

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	11/01/2020	Pre-Release

USER'S MANUAL

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A. OVERVIEW

1.1 Organization of this Manual

Welcome to the NoBoB User Manual. This Manual will show you how to install, configure, and use the NoBoB Android Application with handheld radios. This manual contains the following sections: Overview; Software Installation and Hardware Configuration; UI Overview; and Testing and Troubleshooting.

- The Overview will briefly go over NoBoB's features and will discuss why it may (or may not) be the correct application for your mission.
- Software Installation and Hardware Configuration details how to install NoBoB on an Android phone and what settings on the phone and your radio need to be selected for best performance.
- Using NoBoB gives a short overview of the NoBoB UI.
- Testing and Troubleshooting lists common problems and how you can fix them.

1.2 Purpose

NoBoB allows you to exchange short text messages and GPS information with other users over short, point to point handheld radio links without requiring any sort of infrastructure or network. The GPS data of other users is automatically displayed in OsmAnd (an offline map application) so that users can easily track each other's location.

Data is sent to the radio through the phone's audio jack using an audio cable. Likewise, signals from the radio are received from the radio through the audio jack. Handheld UHF/VHF FM radios that are typically used for voice conversations transmit digital data as audio tones. The achievable data rate over a radio voice channel is low (NoBoB uses 1kbps) but is still useful for transmitting small amounts of data at regular increments. Figure 1 below shows all the hardware needed for two users to communicate using NoBoB. See Section B for a more detailed hardware list.

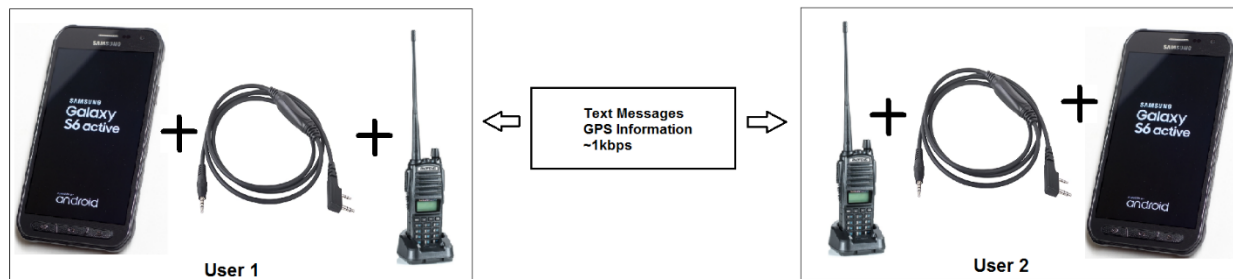


Figure 1

1.2 Why NoBoB?

There are plenty of other HAM radio protocols that also use sound cards to achieve data over voice such as Fldigi, APRS, or IL2P. These are all good protocols (NoBoB's link layer takes heavy inspiration from IL2P) but NoBoB is unique in that it achieves all of the following objectives:

1. **NoBoB is simple to use.** Once the user has the radio and app configured, it will not require the user's full attention to operate. The goal of NoBoB is to be "fire and forget"
2. **NoBoB sends and receives GPS information.** Received GPS information is automatically displayed on a map (if OsmAnd is available). NoBoB can also be configured to regularly beacon your GPS coordinates.
3. **NoBoB doesn't require specialized hardware.** The user only needs an Android phone, an audio cable, and a cheap UHF/VHF radio to get started with NoBoB. These three items can be purchased for less than \$150.
4. **NoBoB uses modern Telecommunication Theory.** A major drawback of APRS is that its AX.25 link layer protocol is dated and packet drops are frequent. NoBoB uses interleaving and forward error correction to improve signal to noise ratio and decrease the number of dropped packets.

B. SOFTWARE INSTALLATION AND HARDWARE CONFIGURATION

2.1 Required Hardware

In general only three pieces of hardware are needed: an Android phone, a VHF/UHF FM radio, and a compatible audio cable to connect the radio and phone.

Most testing and development were done using Samsung Galaxy S6, S9, and S10s with various different version of Android OS. If your phone is newer than a Samsung Galaxy S6, then NoBoB will more than likely work on your phone. It is also important to keep in mind that if the phone you are using does not have a working GPS receiver, the GPS feature will not work. If you are on a budget, you can find working Samsung Galaxy S6's on EBay for less than \$100.

NoBoB was developed using Baofeng UV-82hp radios and APRS-K2 audio cables:

- <https://baofengtech.com/uv-82hp>
- <https://baofengtech.com/aprs-k2-trrs-cable>

In theory, the app should work with any radio and cable that can be connected to a smart phone.

2.2 Required Software

The NoBoB installer will is named something like “NoBoB-0.1-armeabi-v7a-debug.apk”. When installing NoBoB it will ask for permission to access your location, record audio, and read/write to memory. NoBoB requires all of these permissions to function properly. After installing NoBoB and granting the required permissions, it may need to be restarted after installation for the changes to take effect.

You will need to install the free version of *OsmAnd* if you want to see GPS contacts on a map. Do NOT install OsmAnd+ (the paid version). It won't work with NoBoB since from the point of Android OS, OsmAnd and OsmAnd+ are seen as two different applications.

Another application that is not required but is recommended is *GPS Status & Toolbox*. This free application can be used to verify that the GPS receiver is working on your phone.

2.3 Configuring the Radio

In general your radio needs the following settings:

- The Squelch needs to be on a lower setting but not off.
 - On the Baofeng UV-82hp: **SQL=1**
- VOX needs to be enabled. This enables your radio to transmit without having to push the PTT button.
 - On the Baofeng UV-82hp: **VOX=1**
- If you don't have a HAM radio license, set the transmit power to its lowest setting.
 - On the Baofeng UV-82hp: **TXP=LOW**
- If you don't have a HAM radio license, select an FRS Frequency to use. FRS frequencies are in the range **462 to 467MHz**.
- If you do have a HAM radio license and want to use higher power on different frequencies, you are strongly advised to conform to your local band plan and use frequencies that are dedicated to experimental protocols. Also make sure your FCC issued callsign is entered into NoBoB before transmitting.

2.4 Configuring the Android Phone

In order for NoBoB to perform optimally, you will need to change a few of the settings on your phone.

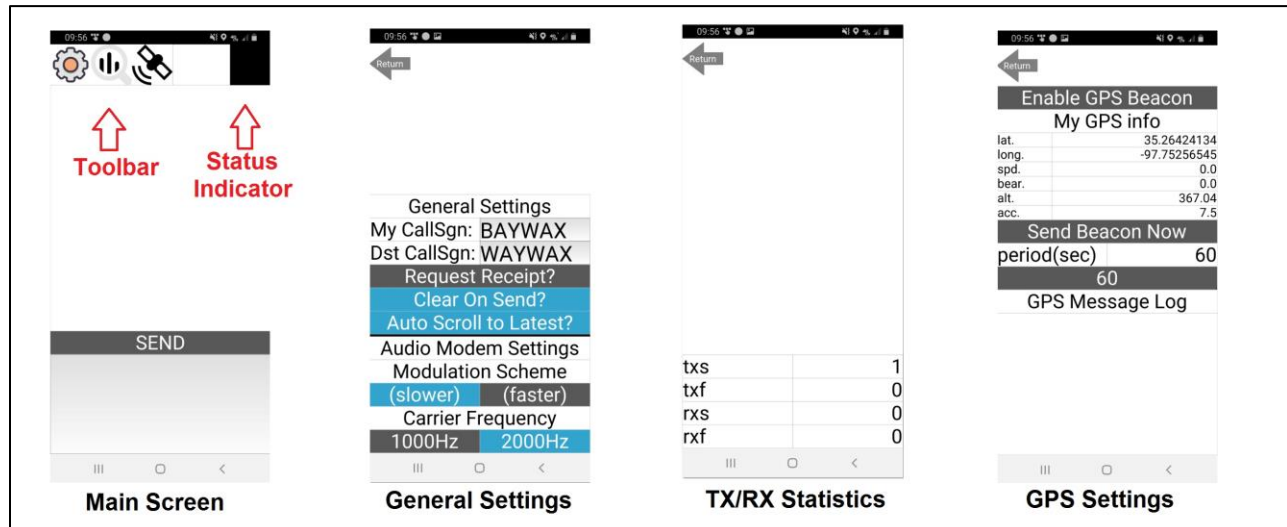
First, you need to set your phone to vibrate. If you don't do this, and you receive a notification from another application, it will play a sound which will be sent to the radio and will interfere with other users in the network. You should also turn on airplane mode since you won't need cellular data, wifi, or Bluetooth while using NoBoB.

Next, find your location settings (Settings > Connections > Location) and set the locating method to use GPS only. By default, Android uses a combination of cellular, wifi, and GPS to get a fix on your location (It may even do this while wifi is disabled). Use the application *GPS Status & Toolbox* to verify that your GPS receiver is working. During development, it was found that the GPS receiver in some phones was faulty or slow to receive a GPS signal. If the GPS receiver in your phone is not working, NoBoB will not be able to transmit your location and will appear to not work.

Finally, make sure the volume on your phone is turned up to a reasonably high volume.

C. UI OVERVIEW

NoBoB's UI is meant to be simple and minimalistic. The four screens in the app are shown in the Figure below.



3.1 Main Screen

The Main Screen is where you can send Text Messages, view received messages, and get to the other settings screens using the buttons in the toolbar on the top left. The most important element of this screen is the Status Indicator located on the top right. The Status Indicator will change colors to indicate state changes of the NoBoB Transceiver. The following colors are used:

- **Black:** No messages are presently being Transmitted or Received
- **Red:** A message is currently being transmitted
- **Blue:** A message is currently being received, but has not yet been decoded.
- **Green:** A message has been successfully received

3.2 General Settings

General Settings contains the following settings. These settings are automatically saved when you change them and will persist even if the app is closed or crashes.

- **My Callsign:** A 6 character, alphanumeric callsign. Messages sent by you will contain this callsign.
- **Dst Callsign:** A 6 character, alphanumeric callsign. Text Messages sent by you will contain this callsign. Whenever someone with this callsign receives one of your messages, it will be indicated that the message was addressed to them.
- **Request Receipt:** A toggle button used to request an acknowledgment from the Destination Callsign. If an acknowledgment is not received within 15 seconds, the message is resent up to 5 times before timing out. This feature is still a work in progress and may change in the future as it is refined.
- **Clear on Send?:** A toggle button used to automatically clear the input text field on the Main Screen when a message is sent.
- **Auto Scroll to Latest?:** A toggle button used to automatically scroll to the latest Text Message that was received.

3.3 TX/RX Statistics

This screen displays four counters keeping track of the number of successful/failed messages that were transmitted/received since the last application restart.

- **txs**: successful transmits
- **txf**: failed transmits
- **rxs**: successful receives
- **rxs**: failed receives

3.4 GPS Settings

This screen allows you to enable your GPS beacon and view received GPS Messages.

- **Enable GPS Beacon**: A toggle button used to enable/disable your GPS beacon. When the beacon is enabled, your GPS coordinates will be transmitted at the rate specified on this screen.
- **My GPS Info**: A label displaying your latest GPS coordinates that have been sent. If these fields are zero, this indicates that you have not transmitted any GPS Messages yet.
- **Send Beacon Now**: A toggle button to manually send a GPS Message, regardless of the current state of the Enable GPS Beacon button.
- **GPS Message Log**: A log showing GPS Messages received from other NoBoB users. Only the latest 5 GPS Messages are shown here. It should also be noted that in addition to being shown here, received GPS Messages are displayed in OsmAnd if it is installed and running.

D. TESTING AND TROUBLESHOOTING

4.1 Testing NoBoB

After installing and configuring the application, you should test it to make sure everything is in working order. First open the NoBoB application, the application icon will look like the figure below:



After a brief splash screen, the Application UI should display. If you get a black screen, try closing the application and restarting it.

Before connecting the audio cable to your phone, let's make sure NoBoB is able to play audio. On the main application screen type in a message and press send. After a few seconds, a 1 to 2kHz carrier tone will play out of the speaker, followed by a warbled signal of the same frequency. This is the audio signal that will be playing into the radio. If the audio does not play, return to section B to verify your phone's settings.

Next, we will test the GPS beacon, go to the GPS Settings and press the "Send Beacon Now" button. After a moment, the data fields under "My GPS info" will be filled with your most up-to-date location and the GPS beacon will play out of the speakers. If all of the fields' values stay at zero and the speakers do not play any sound, this is an indication that your GPS receiver has not achieved a fix on your location. Try opening the *GPS Status & Toolbox* application to verify that your phone's GPS receiver is working correctly. During development, sometimes *GPS Status & Toolbox* had to be opened or the phone had to be moved around for a while for the GPS receiver to work on certain models of phones.

Now you can connect your phone to the radio. Use the audio cable to connect your phone's speaker jack to the radio. Turn the radio on, and set its volume adjustment knob about halfway. Try sending another message or GPS beacon. The radio should now transmit the audio signal (depending on radio model, a backlight or LED is used to indicate when the radio is transmitting or receiving). If you have another radio available, try listening in on the same frequency to verify the audio is being transmitted.

4.2 Receiving a Signal

To successfully receive a signal from the radio, it is critical to have the volume correct. If the radio's volume is too low, NoBoB will have trouble detecting the signal. If the volume is too high, the audio will be distorted and NoBoB will have difficulty decoding it. During development, it was found that setting the volume adjustment knob to half is about correct. There are factors that can cause this to deviate though such as the sensitivity of the phone, the model of radio used, and the strength of the signal received.

It is recommended to first disconnect the radio from the audio cable and listen to incoming signals through the radio's speaker. After some experience, you will gain a sense of whether or not a signal is clean or distorted.

After listening to a signal and adjusting the volume as needed, plug the radio back into the audio cable to see if the volume is correct for NoBoB. Use the receive status indicators on the radio and the NoBoB UI to further adjust the volume. For the following scenarios, take the recommended action to adjust your radio's volume.

<p>Scenario 1: The radio indicates it is receiving a transmission but the status indicator in NoBoB does not turn blue.</p> <ul style="list-style-type: none">• Action: The audio is too quiet for NoBoB. Increase the radio volume slightly and wait for another transmission.
<p>Scenario 2: The radio indicates it is receiving a transmission and the NoBoB status indicator briefly turns blue, but it never turns green.</p> <ul style="list-style-type: none">• Action: The audio from the radio is too loud and distorted. Decrease the radio volume slightly and wait for another transmission.
<p>Scenario 3: The radio indicates it is receiving a transmission and the NoBoB status indicator turns blue, and then turns green.</p> <ul style="list-style-type: none">• Congratulations! You have successfully received a transmission, check for new text messages or GPS messages in NoBoB. If you received a GPS message, go to OsmAnd (if it is installed and open) to see if a Favorites Marker was placed to indicate the call sign, location, and time of the contact.
<p>Scenario 4: I have gone through Scenario 1 several times now and the status indicator never turns blue, it always stays black.</p> <ul style="list-style-type: none">• Action: Your phone's audio settings may not be properly configured, or NoBoB is unable to record audio. Refer to Section B.
<p>Scenario 5: I have gone through Scenario 2 several times now and the status indicator briefly turns blue, but never turns green.</p> <ul style="list-style-type: none">• Action: NoBoB is failing to decode the signal. This means the audio from the radio is distorted or something is amiss with the application. Try listening to the audio from the radio to determine if the signal is distorted and restart NoBoB.