Radio based APRS reporting Wunder-Weather-Station

The APRS enabled WWS provides a one stop solution to disseminating periodic weather data via the world wide APRS packet system operation on 2 meter amateur radio frequencies and can be powered by battery and solar panel.

Overview

The system consists of the main WWS and an add-on APRS nano modem, plus a suitable radio tuned to the APRS frequency 144.390Mhz (in the US) . The WWS main board sends commands and data to the modem via a serial UART link. The modem then connects to the radio through its microphone and Push-To-Talk inputs.

The configuration of the station identification (call sign), location and report frequency is done in the WWS through its web interfacei, however a WiFi connection is not necessary to operate the station after it has been configured.

The station will only transmit on the APRS frequency; no reception, decoding or display of other APRS packets is provided.

As with all things RF, care must be taken not to get feedback into the system. It is therefore advised to operate the radio on an external antenna a few feet away from the main WWS and modem board.

Components

- WWS main board with air-data and wind sensors
- APRS Nano Modem add-on board
- 2M amateur radio (e.g. Baofeng UV-5R)
- External 2M antenna and cabling.
- Enclosure suitable for outdoor use
- Power supply – either battery/solar or mains based
- Amateur radio licenses (Technician)

Connections

The modem connects to the WWS via 3 wires:
1. The pin labeled 5V_2 connects to 5V on the WWS
2. The pin labeled GND connects to GND on the WWS
3. The pin labeled RXD connects to pin #3 of UART1

UART1 pins are located near switch 1 and 2 , The square solder pad is pin #1 ,

The modem connects to the radio with 3 signals :

1. The pin labeled A-OUT connects to the Microphone input of the radio
2. The pin labeled PTT-V+ connects to the PTT input of the radio
3. The pin labeled GND1 connects to the signal ground of the radio

It is suggested to use a cheap ear bud headphone/microphone/ptt cable as provided by the radio manufacturer or available on EBay and cut off the parts not needed. This provides a clean single plug interface at the radio.

An external antenna should be used on the radio to eliminate possible interference issues

WWS Configuration

Before configuring the APRS part you will need to configure the WWS to connect to your WiFi network as usual. Use the provided Bootstrap tool from the website and proceed as outlined in the help section to bring up the station on your network.

One connected, direct your browser to the IP address of the station or use the provided TCP-Discovery tool to locate it on your network. The IP address of the device is displayed by the bootstrap tool when it is first configured or when you reset the board while the Monitor Option is on. Note: The Bootstrap tool crashes if you unplug the USB cable while it's still connected. .

Verify that the WWS is displaying correct values for the sensors attached. You will notice that the wind direction initially shows 0 deg. You first have to calibrate the range and offset of the vane before it starts to display correct values. To do so, click on *Configuration,* (default credentials are admin/admin), then click on "Sensors" and follow the instructions to calibrate the wind vane.

Once everything looks good on the local WWS display you can enable the APRS reporting.

Go to "*Configuration/Station*" and enter the following:

- In the Station ID field your HAM radio call sign – without any suffixes
- Leave the Password field blank
- Station altitude in ft above sea level
- Station Longitude and Latitude – look it up via the provided link
- Enter the update interval in seconds – I usually set it to 11 Seconds for testing the connection and the back down to 300 – 600 seconds for normal operation.
- Choose APRS-RF and select the items you want to report
- Hit save

The station should now start sending APRS messages to the modem after one initial report period has expired. You can observe the communication by watching the TX status led next to R1 and observing that the radio is being turned on and keyed during that time. Make sure your radio is tuned to the appropriate frequency for APRS 144.39mhz in the US, but different elsewhere.

Once the radio goes into transmit you will need to adjust the microphone volume via the trim pot R6. You can use a second radio and listen to the modulation, or better yet use a Software Defined Radio and PC application showing the modulation index and adjust accordingly.

Finally check to see that your transmissions are being received by someone and fed into the APRS internet. Go to APRS.fi in your browser and search for your call sign with a -13 suffix. So for example for my call sign KM6AUX I would search for KM6AUX-13. Inspect the Raw packages and see how the packets are received and rebroadcast.

Operation of the power grid

The WWS and APPRS combination is well suited for off grid operation. In order to reduce the power demand the WWS has a built in feature that completely disables the WiFi portion of the system, therefore reducing the power consumption to < 400mW with active wind sensors and to < 200mW with passive ones.

In order to get into this mode the station needs to be started without a WiFi network present. You can accomplish this in one of three ways.

1. Change the WiFi SSID in the station Configuration to something that doesn't exist.
2. Turn off the hot spot or router that provided the WiFi network.
3. Move the station out of range of the network.

Solutions 2 and 3 are preferred since you can always go back to connect with the station without having to go through the bootstrap tool again.

The WWS station searches for a WiFi network for 3 to 5 minutes after power-up or reset. If it doesn't find a network to connect to it gives up and turns it's WiFi module off to conserve power. During this initial 5 minutes the station does not send out APRS messages, you have to wait out the time, plus the report interval time before an initial packet is going out to the radio.

I use a hotspot created on my tablet to temporarily connect to the station for configuration and then simply turn the hotspot off and hit reset on the station to get into low power mode.