# DEPLOYABLE BPQ NODE/DIGIPEATER FOR EMERGENCY COMMS OR RESIDENTIAL PACKET NETWORKING

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*Prototype Deployable Digital Relay Station -- home made "$10TNC" soundcard-based interface*
*Antenna coax wiring is not yet installed. Battery charger isn't shown.*

## Introduction and Rationale

Most packet digipeaters/node stations are what I call "high-perch" wide-area coverage stations. There may be only one in a community. The SEDAN network nodes are often "high-perch" stations, with a commanding coverage that reaches to the next major city, if the client antenna is high enough. These stations have such large-distance coverage because their antenna height results in a path geometry that keeps the signal out of the lossy trees/houses for the majority of the path geometry, tremendously reducing the path loss, and making the link budget succeed.

The corollary unfortunately is that there is often **no redundancy, no backup.** If the single wide-coverage digipeater/node goes out for *any* reason -- power loss, equipment failure, lightning strike, tornado or hurricane or ice damage -- even *getting to it* may be physically or administratively difficult, and repairing components high on towers or roofs may be risky or impossible in high winds/rain. Specialized personnel may be physically or legally required.

For emergency communications redundancy, it would be good to have a backup system that is much more easily reached.

In the Gainesville, FL  area, we're building a small network of versatile residential packet digital repeater stations, based on the BPQ node software, operating on Raspberry Pi's (running Raspbian Linux).  Each station has an antenna that is far up in a tree or other residential structure, but such that it can be reached or replaced by the homeowner. (e.g., slingshot!)    The tradeoff is that while **maintainability** is achieved, the modest antenna height (typically less than 70 feet) means the coverage area is also modest, perhaps a radius of 6 miles, depending on terrain obstructions.   These small self-contained systems can be built on a small plywood base, and could be very easily transported to a disaster area needing emergency packet digital infrastructure.   The homeowner gradually develops familiarity with the system, and can not only reconfigure to a different frequency if needed (by simply adjusting the 2 meter transceiver) but could do the same in a disaster area, possibly configuring one of many simultaneous (but different frequency)  packet streams running to meet the communications needs of the area.

The Raspberry Pi's have the ability to TCP/IP network over either wired Ethernet or wireless WIFI. The LINBPQ software has the ability to function as a WINLINK RMS (radio message server). Typically these simple servers will only be able to gateway to a still-functioning internet, but the server can be configured to allow alternate connection (or fall-back connection) to an instance of WINLINK RMS_RELAY running in conjunction with an HF WINLINK RMS, which gives the system the ability to project message out over the international PACTOR WINLINK system, should the Internet in the disaster area be non functional.  That give the system tremendous versatility.

## CONSTRUCTION

This simple packet station includes the following components:

- **Raspberry Pi** (version 3) with micro SD card containing Raspbian  Linux operating system, linbpq software, and any needed TNC emulation software (Direwolf, if a soundcard-type interface to the transceiver is being utilized).  Reference: http://www.qsl.net/kx4z/MakingRaspberryPiNodeDigipeater.pdf
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- **USB-type 2-amp cell phone type AC power supply** connected to a  cell-phone backup-battery that supports simultaneous charging and usage (e.g. ZILU 4400mAHr https://www.amazon.com/gp/product/B00MWV1TJ6/ref=od_aui_detailpages00?ie=UTF8&psc=1)
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- **TNC or Soundcard-based interface** -- this could be a TNC-X, a Signalink, or a $10TNC system. Ref: http://www.qsl.net/kx4z/InexpensiveTNC.pdf
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- **2-meter transceiver,** typically with 20-40 watts output.  (e.g. ICOM-28, ICOM-229, FT-1900, FT-2900)  (And, of course, this same idea could be done on any VHF/UHF ham band)
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- **Transceiver Battery:**   7 Amp-Hour 12VDC gel-cel battery (often used to power deer feeders

and home security systems) https://www.walmart.com/ip/ADT-12V7AH-12V-7Ah-Alarm-Battery-This-is-an-AJC-Brand-174-Replacement/102925663

- **12V Battery Charger:** Stanley 1.5 Amp (18 Watt) automated battery maintainer https://www.walmart.com/ip/Stanley-2-amp-Battery-Charger/14560006
- **SWR meter** to provide visual indication of real output power. An inexpensive used HF (CB) type SWR meter may be used instead of a VHF SWR measurement device with the understanding that the relative power will be observable but the SWR measurements are unlikely to be accurate.
- **Antenna:** Some form of installable 2-meter antenna and required coax feedline (may be a commercial antenna, or a homemade J-Pole or Slim Jim). **Recommended to place a few 2-3" turns of coax to provide common -mode RF choke and/or clamp-on ferrite beads to reduce RF currents flowing on the exterior surface of the coax braid, which may contribute to RFI to the digital portions of the station.** The J-pole and Slim-Jim designs inherently incorporate EMP/ESD hardening in the form of their shorted transmission line matching system that shorts out static charges as well as frequencies well below VHF range. http://qsl.net/kx4z/TwoMeterHomeMadeSlimJim.pdf
- **Battery Connections:** I suggest to connect the Stanley battery charger directly to the battery with crimp connectors, and put a 10- or 20- amp fuse in the positive line from the battery to your 2-meter transceiver. This battery will operate the 2-meter rig for a day or more. The Raspberry battery has to support a 300-400 mA drain from the Raspberry alone, so you're looking at 8 hours or less, particularly if you are using a Signalink, which may hit 140 mA on transmit. The $10TNC or TNC-X will draw substantially less. Its main purpose is to guarantee the Linux operating system is not interrupted by a power glitch.