Basic Echolink Station Hardware Configurations

By J. Parrino (N6WZK) and G. Lee (KI6GIG)

Echolink can be a viable EmComm (Emergency Communications) tool. J. Parrino (N6WZK) and G. Lee (KI6GIG) have advocated this for a long time. Every amateur radio EmComm tool has advantages and disadvantages. Many amateur radio operators do not consider Echolink to be useful for EmComm. The number one criticism is "If there is no Internet, Echolink is useless." Well, when atmospheric/band conditions are poor, RF can be rendered useless. Yet no hams seem to say RF is useless for EmComm.

Echolink allows hams to communicate in two basic modes: "User" and "SysOp". When operating as a "User" there is not radio involved. Instead, the "User" operates through a computer, smart phone, or a personal electronic device (PED). This often fuels the criticism that Echolink is not REAL ham radio.

However, in "SysOp" mode, a ham radio can be integrated to work with a computer. A "Link" station enables the Echolink operator to connect with local hams (via RF) with DX hams using VOIP (Voice Over Internet Protocol) via the Internet. Local hams on their radios may or may not be aware they are talking with some of the other hams by computer and the Internet. A "Repeater" station may be able to connect more distant local hams via RF to DX hams using VOIP (Voice Over Internet Protocol) via the Internet.

Hardware Component	Echolink "User" Node	Echolink "Sys Op" Mode	
		Echolink "Link" Node	Echollink "Repeater" Node
Smart Phone / PED[1]	Can use smart phone / PED app or computer with Echolink program	N/A	N/A
Computer (w/ Internet)		computer with Echolink program	
Computer/Radio Interface	N/A	Yes	Yes
Radio[2]	N/A	Transceiver	Separate Transmitter and Receiver needed[4]
Antenna & coax[3]	N/A	Yes	Yes
Mast[5]	N/A	Maybe	Maybe

Table Notes: (Also see the Technical Notes at the end of this paper.)

1. Smart Phone/ PED: Smart Phones and Personal Electronic Devices (PEDs) can access Echolink via a relevant application (app) compatible with the device's operating system. Some apps may not have the same functionality of the full Echolink computer program.
2. Radio: Radio and antenna must be consistent in terms of frequency and power. If multi-band radios are used, antennas should be multi-band.
3. Antenna & Coax: Antenna must be consistent with radio frequency and power.
4. This may not be the case if doing cross-band repeating.
5. Antenna mast only needed if outdoors. It may be possible to use stealth indoor antennas. Life is a compromise. Your situation is unique. Rather than strive for the perfect set up, strive for a functional set up---something that will work to get you on the air.

Echolink "SysOp" mode allows an Echolink station to be in RF contact with other hams. In an EmComm situation, the fact that the ham radio is connected to a computer does not stop it from functioning as a radio. So, if an Echolink "Link" or "Repeater" node lost their Internet connection, it does NOT stop them from being an EmComm operator. The power of the internet comes from its wide use around the world. If disaster strikes an area with Echolink "SysOp" stations, those stations can relay traffic by RF until it reaches a station with an Internet connection. The Internet enables the EmComm traffic to move faster around the globe.

An Example of Echolink Emcomm Without Radios.

On 26 April 2017, a tidal bore sped up the Hooghly River in West Bengal, India. The wave caused a crowded pier to collapse. About 150 children, older women and men, and some service men were pitched into the swift flowing river. Several hams of the West Bengal Radio Club were nearby. They immediately jumped into action. HF communications on 6m and 10m filed due to poor band conditions. The initial EmComm used 2m by HTs. They set up an emergency station with external antennas to contact their club station. After a while, 2m conditions deteriorated and communications ceased. Some WBRC hams with cell phones tried to connect to the VU2MQT-L Echolink node. But it could not be activated due to computer problems. These same hams then connected to the KM6EON-R node 13,111 km away. Other WBRC hams farther from the disaster site were out of radio range. They connected to the KM6EON-R Echolink node as well. Amazingly, the WBRC hams were the only EmComm operators able to establish and maintain communications throughout the incident.

According to the WBRC after action report:
"Using Echolink were Abhrajit Das (VU3YDA) from ground zero, Ambarish Nag Biswas (VU2JFA) from his office in Barasat which is approximately 20 kms from accident zone, Jayanta Baidya (VU3YJB) from Bolpur which is 170 km from accident zone, myself Chandramouli Datta (VU3ZHJ) from my college in South Calcutta which is 60 kms form accident zone , Suman Saurabh (VU3ZHD) from his house in Dumka which is more than 300 km from accident zone and Soubrata De (VU3YGE) from this office in South Kolkata which is 70 kms from accident zone." Other WBRC hams on the KM6EON-R were Rinku (VU2FJB) from the WBRC station, Aman Gupta (VU3GUT), Nil (VU3ZHA), JPM (VU3ZHT), Rambo (VU3YGE), and Runa Mitra (VU3YSQ)."

For those who are unfamiliar with infrastructure in India, it is sometimes difficult to make an Internet connection inside of India. Ironically, sometimes it is easier to make an international Internet connection. Apparently, the latter was true on 26 Apr 2017. The WBRC hams connecting to the KM6EON-R took part the EmComm incident only because of Echolink.

In conversations with Raju (VU2JFA), normal RF communications (HF 6 m and 10m, and VHF 2m) were difficult to impossible. Without using the KM6EON-R Echolink, the WBRC hams would not have been able provide emergency communications during the Telinipara Ghat disaster. Other government emergency responders were amazed the WBRC hams were the only group continued to communicate throughout the incident.

Ironically, when people discuss Echolink in EmComm, the assumption is a disaster will disrupt Internet availability. However, in this case, atmospheric conditions were poor and RF communications failed. The Internet was available and the WBRC hams used Echolink to perform their EmComm duties and served their community in time of crisis.

Technical Notes

Cooling Fans: Heat is the enemy of electronic equipment. To help prolong equipment life, consider using additional cooling fans for the computer and radio.

Station Grounding: Proper station grounding reduces RF problems, improves electrical safety in the station, and provides lightning protection for the radio/antenna systems.

Stabilize Antenna Masts: Be sure the antenna is secured at this base as well as any needed guying. Try to set masts up so that if they fail, you won't have to deal with them falling into power lines or onto other people's property.

Radio(s): You can use HTs as the radio for an Echolink station. However, this low-cost alternative is discouraged. HT's have limited power (usually a max of 3-5 watts). Also, they will tend to heat up when in transmit mode. Mobile radios tend to have 25-35 watts of transmitting power. Many come with a small cooling fan.

Operating Frequency: This depends on how busy or congested the operating frequencies are in your area. In some areas, 2m is very congested. This makes it difficult to find a clear frequency to use (especially if you need a frequency pair for a repeater). Cross-band repeating may be a viable alternative. This means you receive on one frequency (for example 2m) and transmit on another (for example 220 MHz).

Antenna: Whatever operating frequency you end up using, be sure the antenna and power capacity are consistent. For example, if you have a multi-band radio (2m, 220 MHz and 440 MHz), it is best to get a tri-band antenna for the same frequencies. You will want to get the highest gain antenna you can afford. [**Note:** When planning your station, consider spending more on an excellent antenna. The best radio in the world cannot perform well with a poor antenna.]

Coax: Not all coax is created equal. However, there is no need to spend more money on high priced coax unnecessarily. Consider your situation. Are you using an antenna rotator? If so, used coax with a stranded center conductor. If you plan to set up the antenna and not move it, RG8 solid center conductor is fine. Is the installation, short-term, portable? Then lighter weight coax (RG58 or RG8X) might be more suitable. We prefer coax with solid PE (polyethylene) dielectric. If operating at UHF/VHF frequencies with coax runs less than 100 feet, lossy cables are less noticeable. But for HF work and long cable runs, coax loss is more significant.

Battery Backup: How resilient is your station? How will you operate if there is no power? If you set up a battery bank, how will you recharge it? Recharging batteries has its challenges: type of recharging, necessary fuel or energy; most batteries should be charged in well-ventilated spaces.

Computer-Radio Interface: There are various interface units available. Some can be as simple kits costing about $10 (http://www.ebay.com/itm/EASY-DIGI-Sound-Card-Interface-PSK-RTTY-SSTV-NBEMS-JT-65-PCB-KIT/222365408864?_trksid=p2047675.c100623.m-1&_trkparms=aid%3D222007%26algo%3DSIC.MBE%26ao%3D2%26asc%3D40130%26meid%3D38f8e66803e14f6a995223c4dc0223d1%26pid%3D100623%26rk%3D2%26rkt%3D6%26mehot%3Dpp%26sd%3D220896968460). Rigblaster has several model interface units ranging from $60-$300 (http://www.westmountainradio.com/rigblaster.php)

Station Resilience

Any amateur radio station and operator preparing for EmComm strives for resilience. Disasters and accidents tend to make any plans obsolete. Accidents are unpredictable and rapid. There's hardly time to react to avoid them. Below are some of the key items we feel should be assessed to keep your station resilient.

<table>
<tr><td>Back-up Power</td><td colspan="3">Radios and computers need power to work. We have battery banks for back-up power. For our stations, we have separate battery banks for the radios and. computers. The radios operate on 12 VDC. The computer and other units require 120 VAC. We have an inverter to supply power to the 120 VDC items. In addition to our station battery banks, we maintain two banks of field batteries, and two individual batteries for test rigs. [Note: If circumstances warrant, we would limit Echolink and computer use in favor or conserving power for radio operations.</td></tr>
<tr><td rowspan="4">Recharging batteries</td><td rowspan="2">120 VAC</td><td>Float</td><td rowspan="4">This is a juggling act between the battery storage capacity, the solar energy input, and the power draw of your station. In the end, your EcComm duty cycle will be limited by the power available. We have small 1.5 watt solar panels to float charge field radio batteries when they are not in use. Ultimately we would like to run the entire station on solar power. We prefer not to run a generator to avoid the hazards of storing fuel. We have a system to charge our radio batteries while driving long distances independent of the vehicle battery charging system.</td></tr>
<tr><td>Regular</td></tr>
<tr><td rowspan="2">Solar</td><td>Float</td></tr>
<tr><td>Regular</td></tr>
<tr><td>Grounding</td><td colspan="3">We ground our stations and equipment for 1) electrical safety; 2) RF interference; 3) lightning safety.</td></tr>
<tr><td>Power Surges</td><td colspan="3">We suggest taking all reasonable precautions to protect against power surges. Our first line of defense is a surge protector between the wall socket and the power supply. Next is a fuse block between the power supply and the charge controller. The charge controller regulated the electricity used to charge the batteries. There is another fuse block at the power distribution panel going to the radios.</td></tr>
<tr><td>Spare Radio</td><td colspan="3">We keep at least on back-up radio, battery, and portable antenna in a metal ammo can. This serves as a Faraday cage to protect the equipment from EMP effects (Electromagnetic Pulse). The ammo can is also air tight and waterproof.</td></tr>
<tr><td>Spare Antenna</td><td colspan="3">The climate records so strong winds visit our area. So, in the event our antenna is blown down or suffers wind damage, we have spare antennas for emergencies. They range from small magmounts that will fit on a steel filing cabinet to outdoor antennas that can be rigged in trees or portable push-up masts.</td></tr>
<tr><td>Alternate Operating Site</td><td colspan="3">While we prefer to shelter in place, we also have pre=selected alternate operating sites. Field practice involves operating portable from these sites to test and confirm simplex contacts with other hams.</td></tr>
<tr><td>Food & Water</td><td colspan="3">In assessing our local geohazards, we estimate we might need to wait 72 hrs. to 3 weeks or longer before relief arrives. We strive to have about 2-3 weeks of food and water to support ourselves until resupply is possible. Our plans are to shelter in place. However, if circumstances warrant, we are prepared to evacuate. But our supplies will be much more limited to what we can carry on our backs. In the long run, we are hoping to relocate out of an urban area to a more rural setting.</td></tr>
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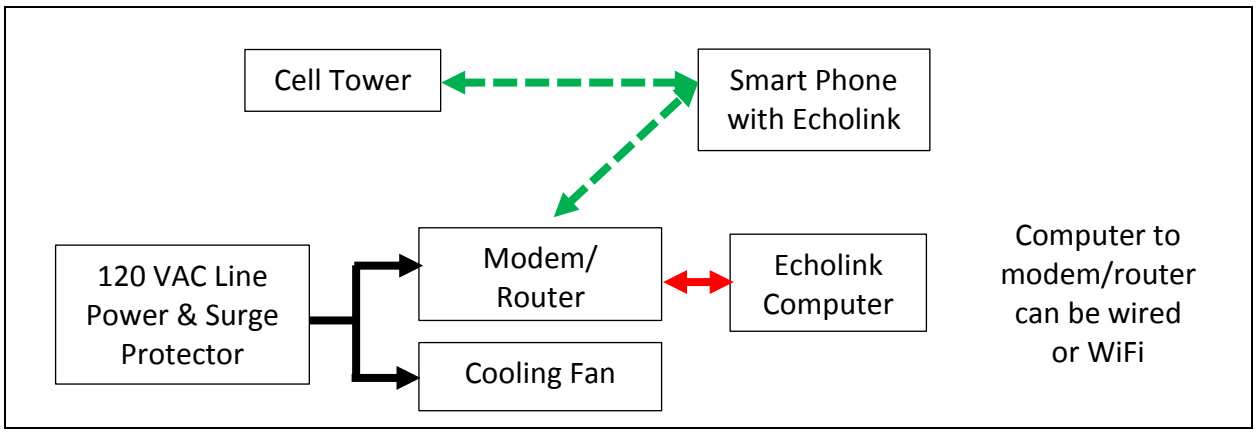
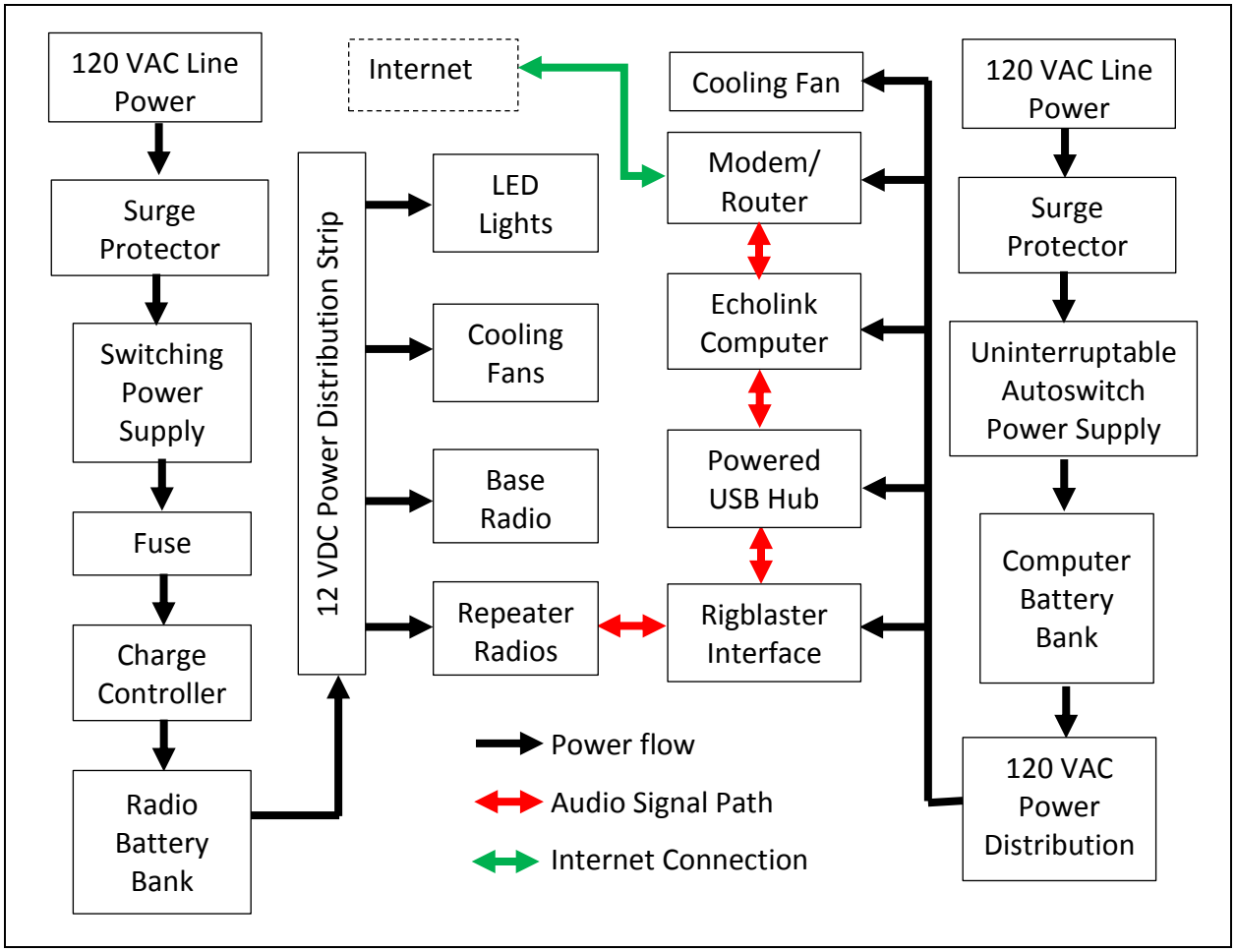
Minimal Echolink "User" Node



KM6EON-Repeater Echolink Station Power Layout



Joe (N6WZK) and Greg (KI6GIG) sought to create a resilient Echolink Repeater station. Power is the essential key to keeping the station operational. The separate battery banks for the radios and the 120 VAC equipment assures that the radios can continue to work if it is necessary to shut fown the 120 VAC equipment to conserve power. If Echcolink is unavailable due to infrastructure disruption, we fall back to radio operations.