

Setting up a remote accessible node using Echolink



November 28, 2022
AIARC Club Monthly Meeting

Echolink Overview

- A software application distributed free of charge that enables Amateur Radio operators to communicate remotely via the internet.
- Uses Voice over IP (VoIP) to transport digitized audio information.
- The Echolink usecase: A remote user using a smartphone/laptop can communicate over the internet to an Echolink VHF/UHF repeater or an Echolink connected VHF/UHF amateur transceiver.
- Enables an off island, out of the area club member to participate in our club simplex net remotely.
- You must have a valid Amateur Radio License to use Echolink. Echolink has a license validation process. See echolink.org for details.
- EchoLink will accept validation for a club or repeater callsign if a valid copy of the club station's license document is provided.

Echolink: Remote user net participation

Example 1

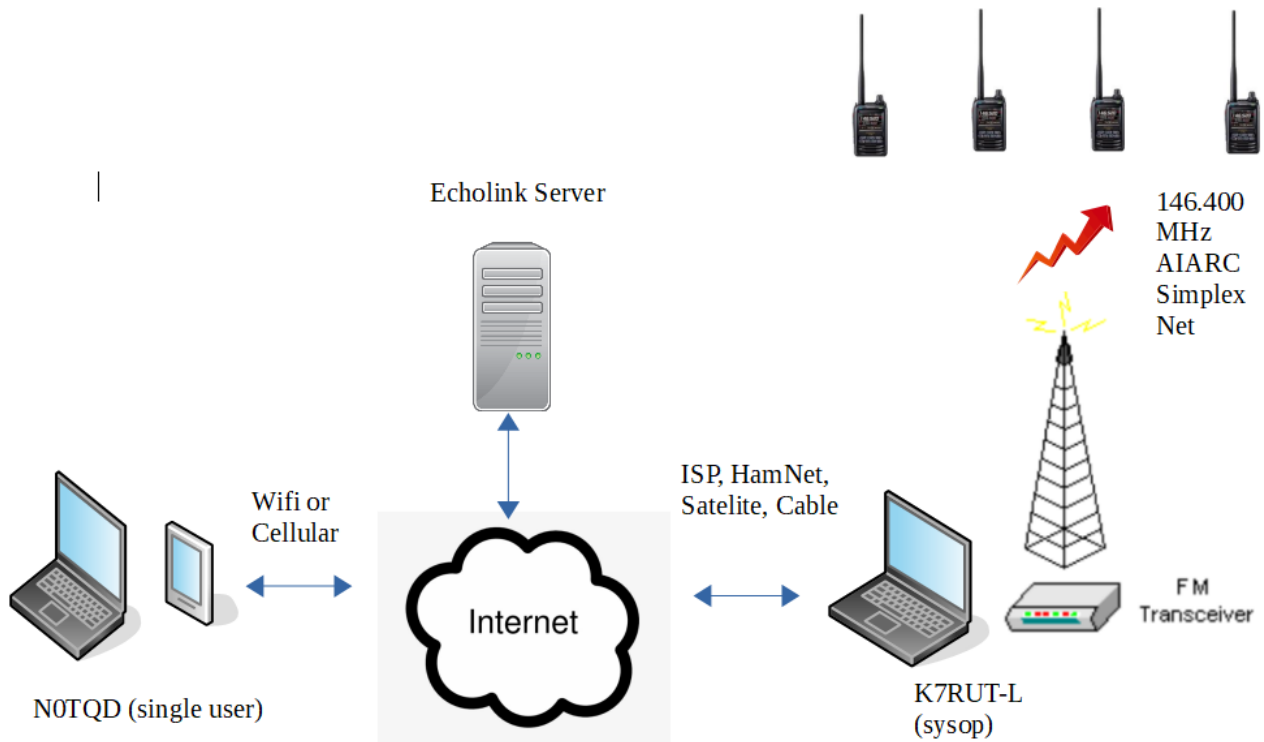


Fig 1 N0TQD operating from Colorado using an iPad with Echolink software

Echolink: Remote user net participation

Example 2

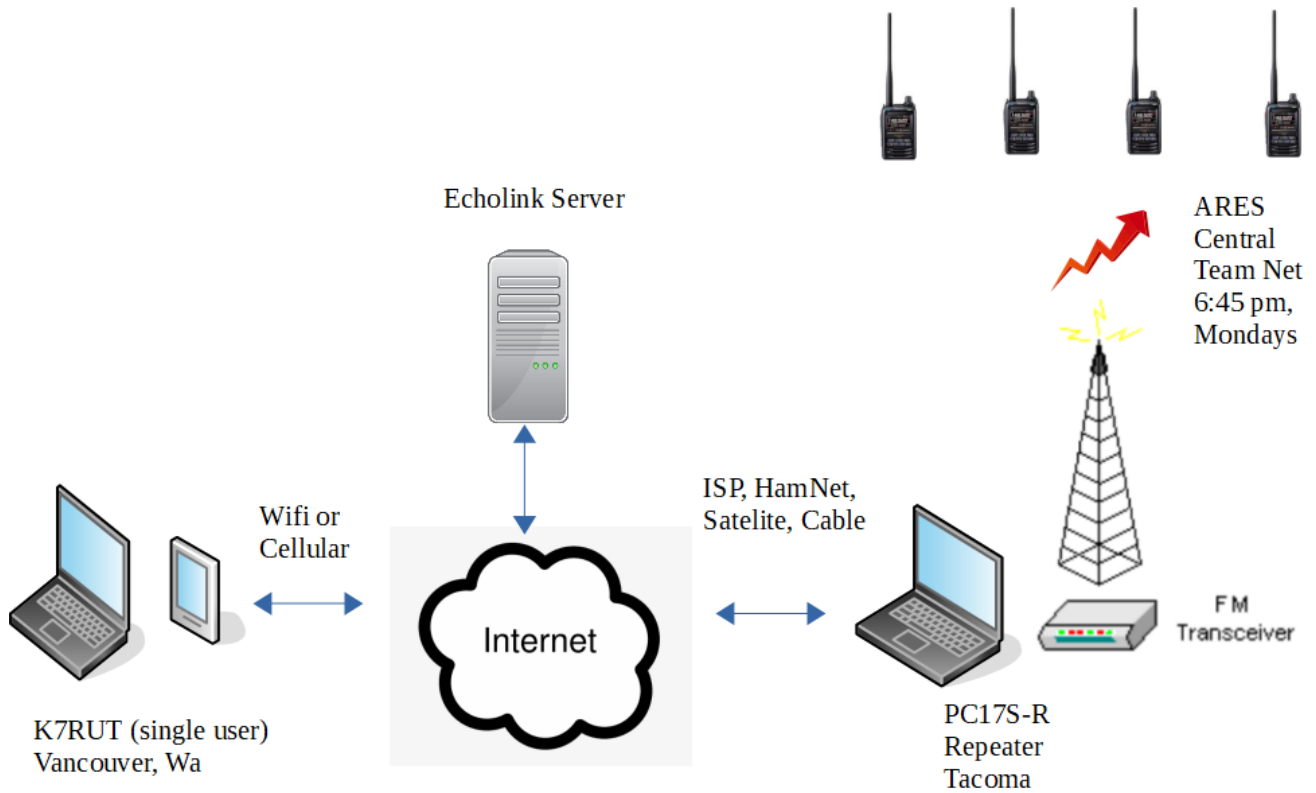


Fig 2 K7RUT operating single user mode on a laptop, ARES Central Team net check in

Simplex Hardware Setup

An Echolink node uses the following hardware setup: VHF/UHF FM transceiver, computer interface, laptop. Interface example: Tigetronics SignalLink. Same as my vara FM Winlink station!

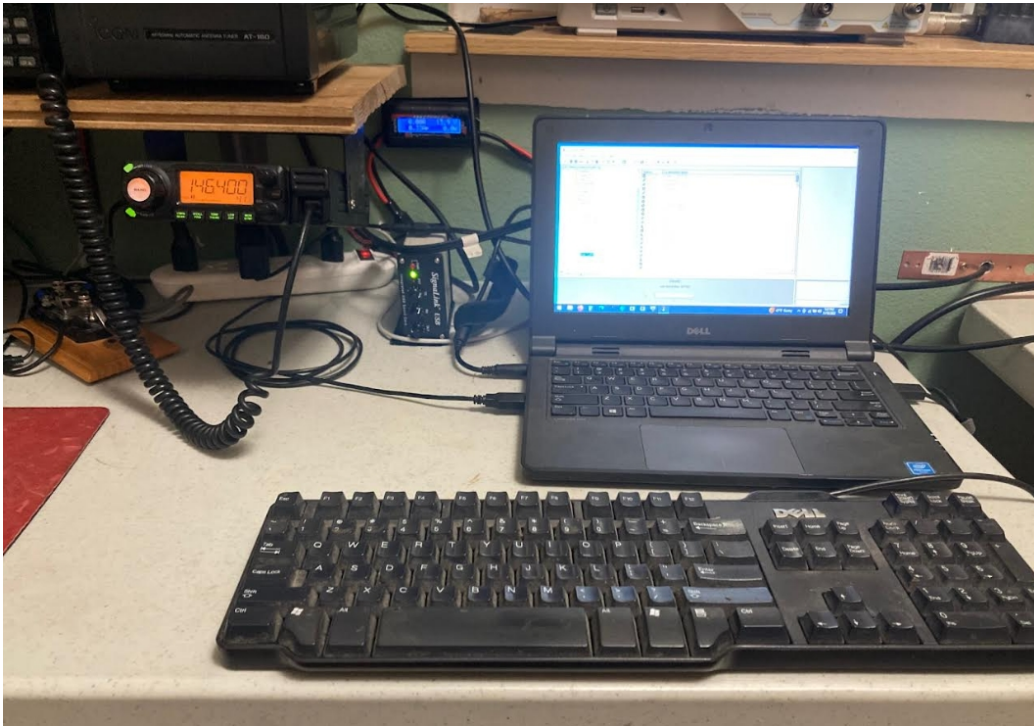


Fig. 3 K7RUT-L, 146.400 Simplex Node

What is Echolink “Voice Over IP” (VOIP)

- Microphone voice converted to 1/0s using A/D hardware
- Performs compression on voice data (Codec)
- Packetizes voice encoded data.
- Packets include header information for source and destination address, encoding and the “payload” (Audio data).
- Packets are sent using the Internet Protocol (IP)
- Packets are received at destination and parsed
- Payload is reassembled into continuous buffer
- Data is decoded, back to original uncompressed data 1/0s
- Convert 1/0s back to voice audio
- Echolink Server’s main job is to provide source and destination address paths to end user nodes
- Once end user’s routes are established, audio is streamed P2P directly between end user nodes
- Echolink uses a proprietary protocol over UDP. (Wireshark demo)

The image shows a Wireshark network traffic capture. The top pane displays a list of captured packets, all of which are UDP packets from source IP 54.176.61.77 to destination IP 192.168.0.3. The selected packet (No. 192) is expanded in the bottom pane to show its details:

- 0100 = Version: 4
- ... 0101 = Header Length: 20 bytes (5)
- > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
- Total Length: 172
- Identification: 0x80bd (34493)
- > 010. = Flags: 0x2, Don't fragment
- ... 0 0000 0000 0000 = Fragment Offset: 0
- Time to Live: 48
- Protocol: UDP (17)
- Header Checksum: 0x80bd [validation disabled]
- [Header checksum status: Unverified]
- Source Address: 54.176.61.77
- Destination Address: 192.168.0.3
- > User Datagram Protocol, Src Port: 5198, Dst Port: 5198
- Source Port: 5198
- Destination Port: 5198
- Length: 152
- Checksum: 0x974d [unverified]
- [Checksum Status: Unverified]
- [Stream index: 9]
- > [Timestamps]
- UDP payload (144 bytes)
- [Community ID: 1:KDjYByc5qkdl6jchs7yXy4Ynd+]

The packet bytes pane shows the raw hexadecimal and ASCII representation of the packet data, starting with 0c b5 0b 21 b6 33 70 f2 20 e7 e0 00 08 00 45 00.

Echolink "Node" Setup

- Each EchoLink installation has an assigned "Node" number.
- This Node number is assigned and bound to a call sign upon initial registration
- There are two different node types: Single User and Sysop.
- There are two types of Sysop nodes: Repeater (-R) and Simplex (-L)

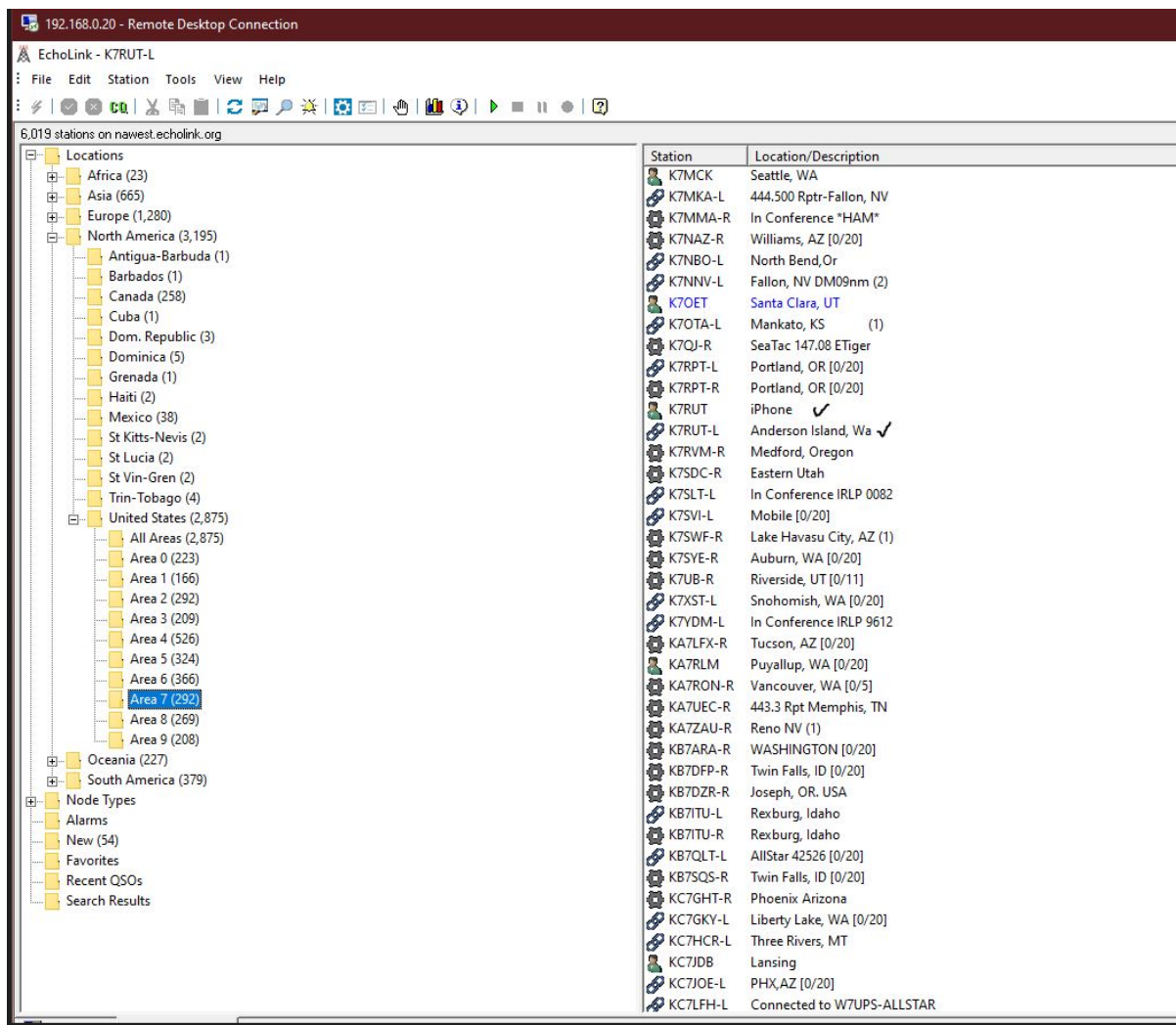


Fig 4 Main Echolink Software Screen

Echolink Servers

- The EchoLink servers are installed at various locations around the world.
- Typically, 4 servers are online at a given time. The total load is balanced among them so that no single server becomes overloaded.
- The servers replicate (exchange data) with each other every 20 seconds so that all servers in the network show essentially the same information.
- Users are automatically shifted to another server in case one (or more) fails.
- This architecture has proven to be highly reliable, with the system experiencing a 99.999% up time since September 1, 2002, even as load has increased from about 300 users online at a time to more than 6,000.
- The servers now process more than 2,000,000 transactions per day.
- The servers are operated on Linux virtual instances in the Amazon Elastic Compute Cloud (EC2).
- The cloud servers are in various locations in the United States and Europe.
- It is estimated that this arrangement of servers can support about 5 times the current worldwide load.

Simplex Node Configuration

The Echolink Node configuration has many options. Most of the defaults can be used initially. Some key options that need to be setup are as follows:

1. Set Sysop Mode

The screenshot shows the EchoLink software interface. A "System Setup" dialog box is open, displaying the "My Station" tab. The "Mode" section has "Sysop" selected with a red checkmark. The "Callsign" field contains "K7RUT-L", the "Name" field contains "Brian", and the "Location" field contains "Anderson Island, Wa". The "Email Addr" field contains "ramey.brian@gmail.com". The "Store password locally" checkbox is checked. The background shows a tree view of locations and a list of stations.

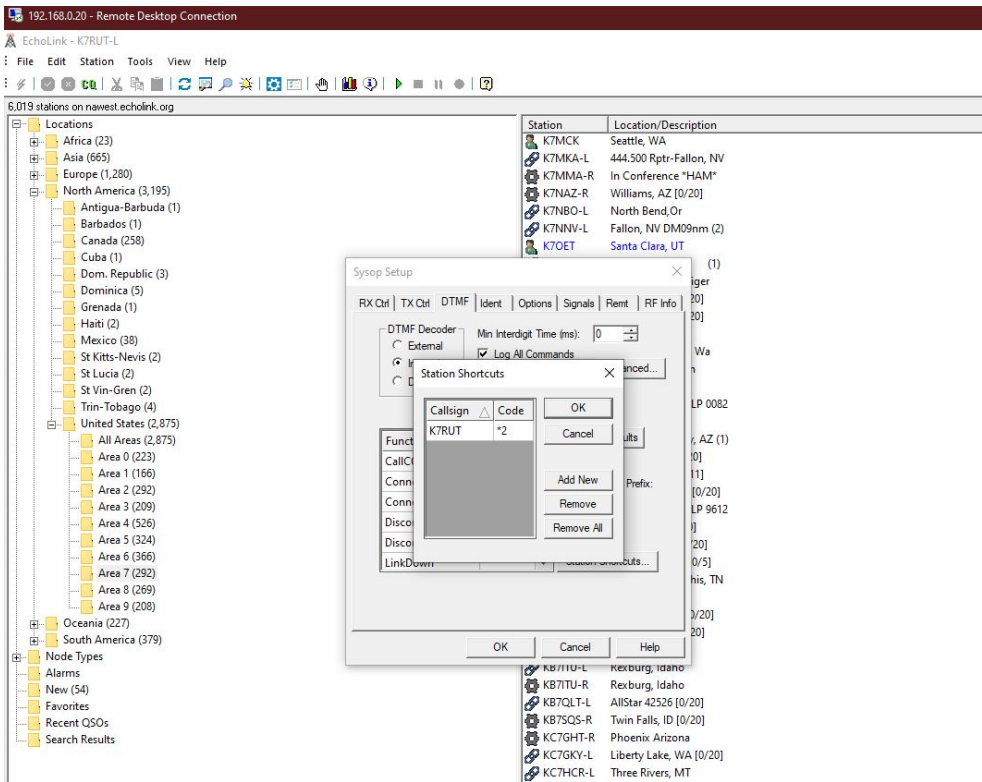
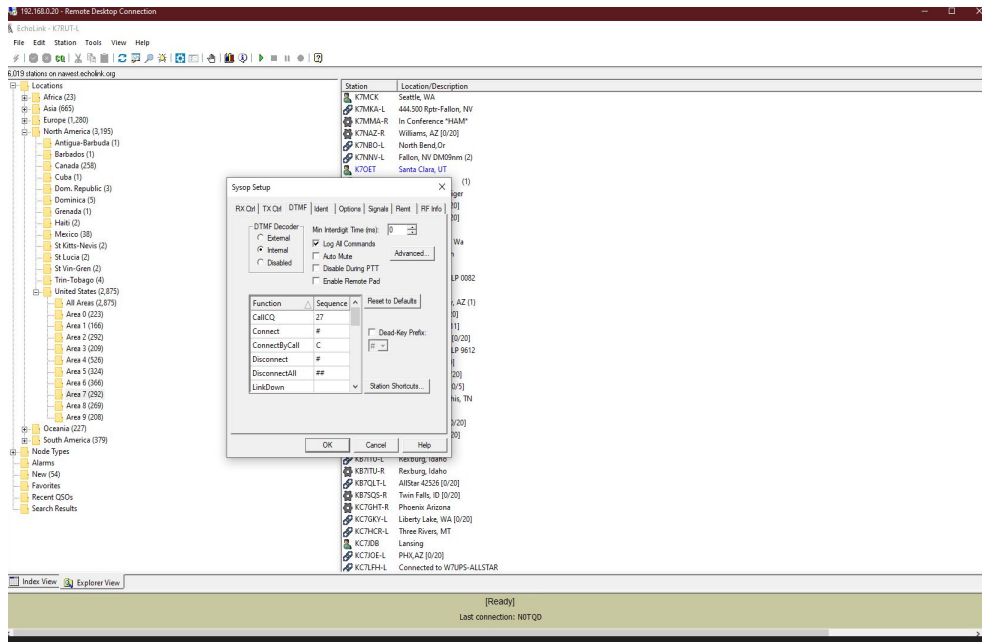
Station	Location/Description
K7MCK	Seattle, WA
K7MKA-L	444.500 Rptr-Fallon, NV
K7MMA-R	In Conference "HAM"
K7NAZ-R	Williams, AZ [0/20]
K7NBO-L	North Bend, Or
K7NNV-L	Fallon, NV DM09nm (2)
K7OET	Santa Clara, UT
K7OTA-L	Mankato, KS (1)
K7QJ-R	SeaTac 147.08 ETiger
K7RPT-L	Portland, OR [0/20]
K7RPT-R	Portland, OR [0/20]
K7RUT	iPhone
K7RUT-L	Anderson Island, Wa
K7RVM-R	Medford, Oregon
K7SDC-R	Eastern Utah
K7SLT-L	In Conference IRLP 0082
K7SVI-L	Mobile [0/20]
K7SWF-R	Lake Havasu City, AZ (1)
K7SVE-R	Auburn, WA [0/20]
K7UB-R	Riverside, UT [0/11]
K7XST-L	Snohomish, WA [0/20]
K7YDM-L	In Conference IRLP 9612
KA7LFX-R	Tucson, AZ [0/20]
KA7RLM	Puyallup, WA [0/20]
KA7RON-R	Vancouver, WA [0/5]
KA7UEC-R	443.3 Rpt Memphis, TN
KA7ZAU-R	Reno NV (1)
KB7ARA-R	WASHINGTON [0/20]
KB7DFP-R	Twin Falls, ID [0/20]
KB7DZR-R	Joseph, OR, USA
KB7ITU-L	Rexburg, Idaho
KB7ITU-R	Rexburg, Idaho
KB7QLT-L	AllStar 42526 [0/20]
KB7SQS-R	Twin Falls, ID [0/20]
KC7GHT-R	Phoenix Arizona
KC7GKY-L	Liberty Lake, WA [0/20]
KC7HCR-L	Three Rivers, MT
KC7ILX	samsung SM-A125U1 User
KC7JDB	Lansing
KC7JOE-L	PHX,AZ [0/20]

2. Configure Station ID.

The screenshot shows the EchoLink software interface with a remote desktop connection to 192.168.0.20. The main window displays a list of stations and a 'Sysop Setup' dialog box. The dialog box is titled 'Sysop Setup' and has tabs for 'RX Ctrl', 'TX Ctrl', 'DTMF', 'Ident', 'Options', 'Signals', 'Rent', and 'RF Info'. The 'Ident' tab is selected, showing 'Station Identification' options. The 'Morse' option is checked, and the call sign 'K7RUT' is entered in the text field. The 'Spoken Voice' and 'External file' options are unchecked. Under the 'Identify' section, the following options are checked: 'While active, every 10 min', 'While not active, every 10 min', and 'Wait for clear frequency'. The 'Each time a station connects' and 'Each time a station disconnects' options are unchecked. The 'At end of transmission, every 10 min' option is also unchecked. The background shows a tree view of locations and a list of stations with their call signs and locations.

Station	Location/Description
K7MCK	Seattle, WA
K7MKA-L	444.500 Rptr-Fallon, NV
K7MMA-R	In Conference *HAM*
K7NAZ-R	Williams, AZ [0/20]
K7NBO-L	North Bend, Or
K7NNV-L	Fallon, NV DM09nm (2)
K7OET	Santa Clara, UT
K87TU-L	Rexburg, Idaho
K87TU-R	Rexburg, Idaho
K87OLT-L	AllStar 42526 [0/20]
K87SQS-R	Twin Falls, ID [0/20]
KC7GHT-R	Phoenix Arizona
KC7GKY-L	Liberty Lake, WA [0/20]
KC7HCR-L	Three Rivers, MT
KC7JDB	Lansing
KC7JOE-L	PHX,AZ [0/20]
KC7LHH-L	Connected to W7UPS-ALLSTAR

3. DTMF configuration



4. Security Configuration

192.168.0.20 - Remote Desktop Connection

EchoLink - K7RUT-L

File Edit Station Tools View Help

6,033 stations on newest.echolink.org

- Locations
 - Africa (23)
 - Asia (680)
 - Europe (1,276)
 - North America (3,198)
 - Barbados (1)
 - Canada (259)
 - Cuba (1)
 - Dom. Republic (3)
 - Dominica (5)
 - Grenada (1)
 - Haiti (2)
 - Mexico (37)
 - St Kitts-Nevis (2)
 - St Lucia (2)
 - St Vin-Gren (2)
 - Trin-Tobago (4)
 - United States (2,879)
 - All Areas (2,879)
 - Area 0 (222)
 - Area 1 (167)
 - Area 2 (290)
 - Area 3 (209)
 - Area 4 (533)
 - Area 5 (323)
 - Area 6 (366)
 - Area 7 (295)
 - Area 8 (266)
 - Area 9 (208)
 - Oceania (228)
 - South America (378)
- Node Types
 - Alarms
 - New (71)
 - Favorites
 - Recent QSOs
 - Search Results

Station	Location/Description
K7MCK	Seattle, WA
K7MKA-L	444.500 Rptr-Fallon, NV
K7MMA-R	In Conference "HAM"
K7NAZ-R	Williams, AZ [0/20]
K7NBO-L	North Bend, Or
K7NNV-L	Fallon, NV DM09nm (2)
K7OET	Santa Clara, UT
	Mankato, KS (1)
	SeaTac 147.08 ETiger
	Portland, OR [0/20]
	Portland, OR [0/20]
	Anderson Island, Wa
	Medford, Oregon
	Eastern Utah
	In Conference IRLP 0082
	Mobile [0/20]
	Lake Havasu City, AZ (1)
	Auburn, WA [0/20]
	Riverside, UT [0/11]
	Snohomish, WA [0/20]
	In Conference IRLP 9612
	Tucson, AZ [0/20]
	Puyallup, WA [0/20]
	Vancouver, WA [0/5]
	443.3 Rpt Memphis, TN
	Reno NV (1)
	WASHINGTON [0/20]
	Twin Falls, ID [0/20]
	Joseph, OR. USA
	Rexburg, Idaho
	Rexburg, Idaho
KB7ITU-R	Rexburg, Idaho
KB7QLT-L	AllStar 42526 [0/20]
KB7SQS-R	Twin Falls, ID [0/20]
KC7GHT-R	Phoenix Arizona
KC7GKY-L	Liberty Lake, WA [0/20]
KC7HCR-L	Three Rivers, MT
KC7LX	samsung SM-A125U1 User
KC7JDB	Lansing
KC7JOE-L	PHX,AZ [0/20]
KC7LFH-L	Connected to W7UPS-ALLSTAR

Preferences

List | Connections | **Security** | Signals

Accept conns from: Accept only these calls: Deny these calls:

Repeaters (-R)

Links (-L)

Users

Conferences

Dynamic conf detect

International Prefixes

Accept	Deny
Afghanistan	
Albania	
Algeria	
Andorra	
Angola	
Antigua-Barbuda	
Armenia	

Apply security settings to: Inbound connection requests Outbound connection attempts

OK Cancel Help

[Ready]
Last connection: *ECHOTEST*

One last thing.... Enable port forwarding on your internet modem for ports 5198,5199.



- Blocking/Filtering**
 - [Access Scheduler](#)
 - [Service Blocking](#)
 - [Website Blocking](#)
- Broadband Settings**
- WAN Settings**
 - [WAN Settings](#)
 - [Dynamic DNS](#)
- LAN Settings**
 - [DHCP Settings](#)
 - [DHCP Reservation](#)
 - [DNS Host Mapping](#)
 - [LAN Subnets](#)
- QoS**
- Remote Management**
 - [Remote GUI](#)
 - [Remote Console](#)
- Routing**
 - [Dynamic Routing](#)
 - [Static Routing](#)
- Security**
 - [Administrator Password](#)
 - [Applications Forwarding](#)
 - Port Forwarding**
 - [DMZ Hosting](#)
 - [IPv4 Firewall](#)
 - [IPv6 Firewall](#)
 - [NAT](#)
 - [UPnP](#)
 - [SIP ALG](#)



Port Forwarding

Enter ports or port ranges required to forward Internet applications to a LAN device below.

1. Select the LAN device, or manually enter an IP address.

Select Device:

Enter IP Address:

LAN Starting Port: (Optional)

2. Select protocol, then enter the WAN ports to forward.

Protocol:

WAN Starting Port:

WAN Ending Port:

3. Enter the source IP address details.

Source IP State: All IP Addresses Define IP Address

4. Click "Apply" to save your settings.

Port Forwarding List				
LAN IP and Port	Protocol	WAN Ports	Source IP	Edit
192.168.0.20	UDP	5198 - 5199	N/A	<input type="button" value="Remove"/>