

Merrimack Valley Digital Network

Mesh Networking Basics

Purpose

Overview for Planning and Implementing
a Microwave Mesh Network

Topics

- Modeling microwave links
- AREDN supported platforms and firmware
- Node configuration
- Internet tunnels for training and maintenance
- Network services – similar to internet services
- Example: Crotched – Uncanoonuc DMR Project

Radio Mobile Online Model

https://www.ve2dbe.com/rmonline_s.asp

 [Radio Mobile](#) Par/By Roger Coudé VE2DBE [Information](#) 



This tool is sponsored by **TowerCoverage.com** commandite cet outil



Radio Mobile Online / En ligne

[Try the new Windows Desktop version - RmWeb 2.1.2.0 - Essayez la nouvelle version pour bureau Windows](#)

Utilisateur	<input type="text"/>	User
Mot de passe	<input type="password"/>	Password
<input type="button" value="Soumettre - Submit"/>		

Create a New account	English	Lost your user name or password...
Créer un Nouveau compte	Français	Perdu votre nom d'utilisateur ou le mot de passe...
Crea una cuenta nueva	Español	Perdiste tu nombre de usuario o contraseña...
Crea un nuovo Account	Italiano	Dimenticato username o password...

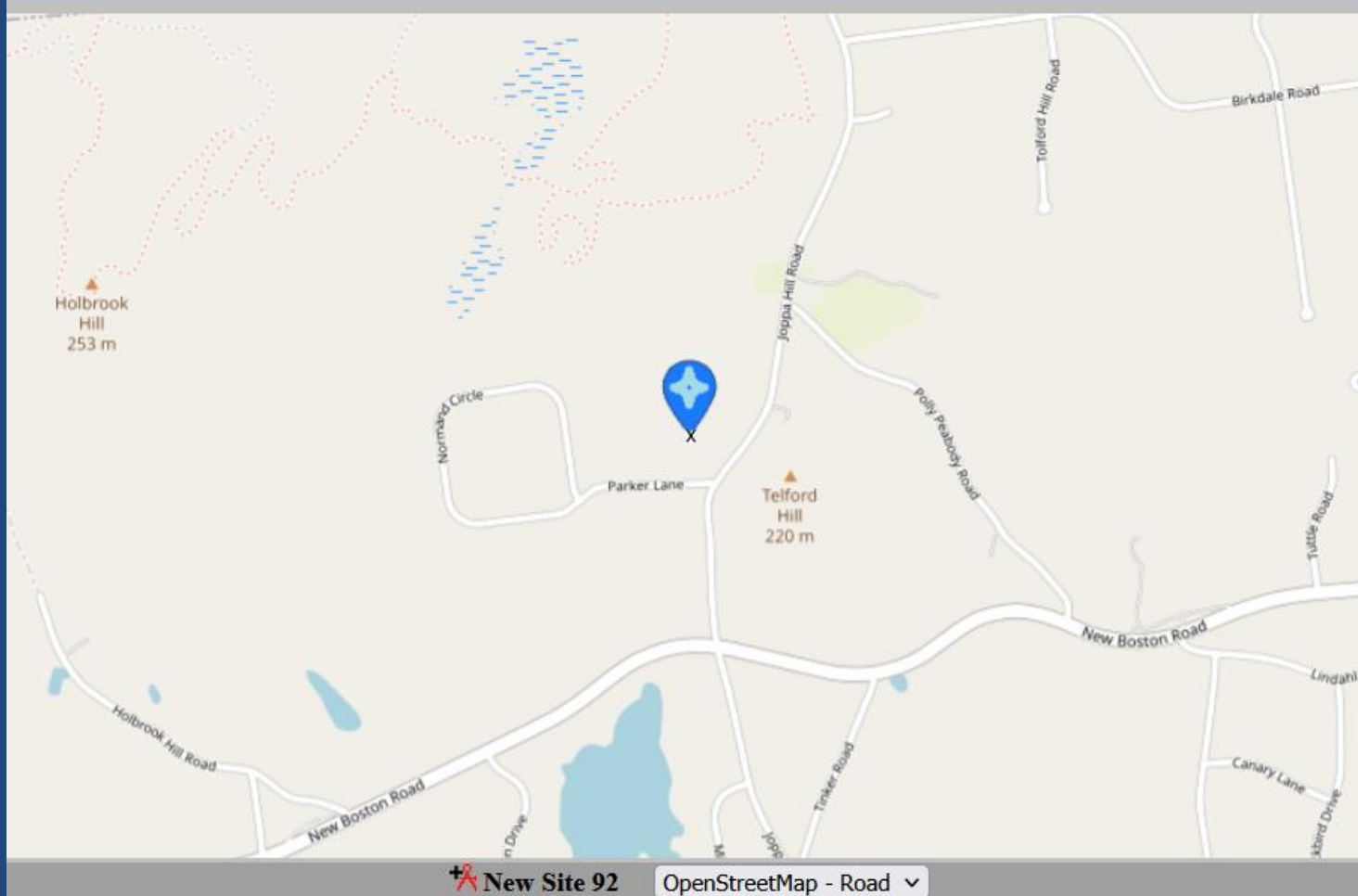
A free tool for amateur radio Un outil gratuit pour la radio amateur



Radio Mobile Online Model

Locate sites on map

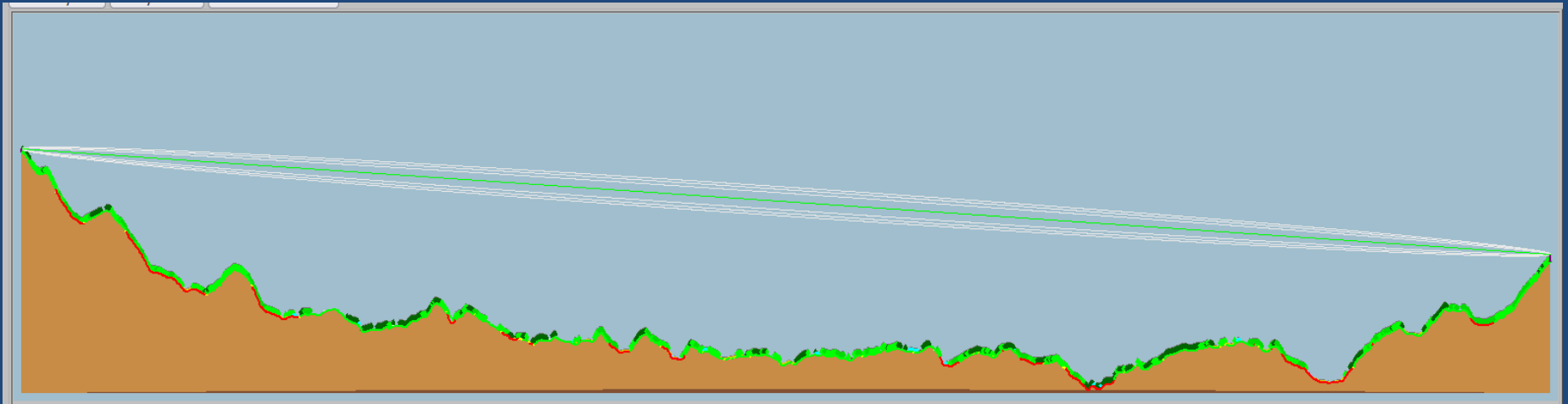
Par/By Roger Coudé VE2DBE



Radio Mobile Online Model - Input

From	<input type="text" value="Crotched Mt"/>	▼
Antenna height (m above ground)	<input type="text" value="5"/>	16.40 ft
<hr/>		
To	<input type="text" value="Uncanoonuc"/>	▼
Antenna height (m above ground)	<input type="text" value="15"/>	49.21 ft
<hr/>		
Description	<input type="text" value="Crotched to Uncanoonuc 5Gt"/>	
Frequency (MHz)	<input type="text" value="5720"/>	
Tx power (Watts)	<input type="text" value="0.4"/>	26.02 dBm
Tx line loss (dB)	<input type="text" value="0.1"/>	
Tx antenna gain (dBi)	<input type="text" value="20"/>	← Max gain minus 3dB for Polarization Diversity
Rx antenna gain (dBi)	<input type="text" value="20"/>	← Max gain minus 3dB for Polarization Diversity
Rx line loss (dB)	<input type="text" value="0.1"/>	
Rx threshold (μV)	<input type="text" value="0.5"/>	-113.02 dBm
Required reliability (%)	<input type="text" value="95"/>	→

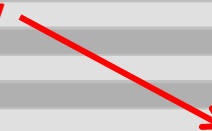
Radio Mobile Online Model Output Profile



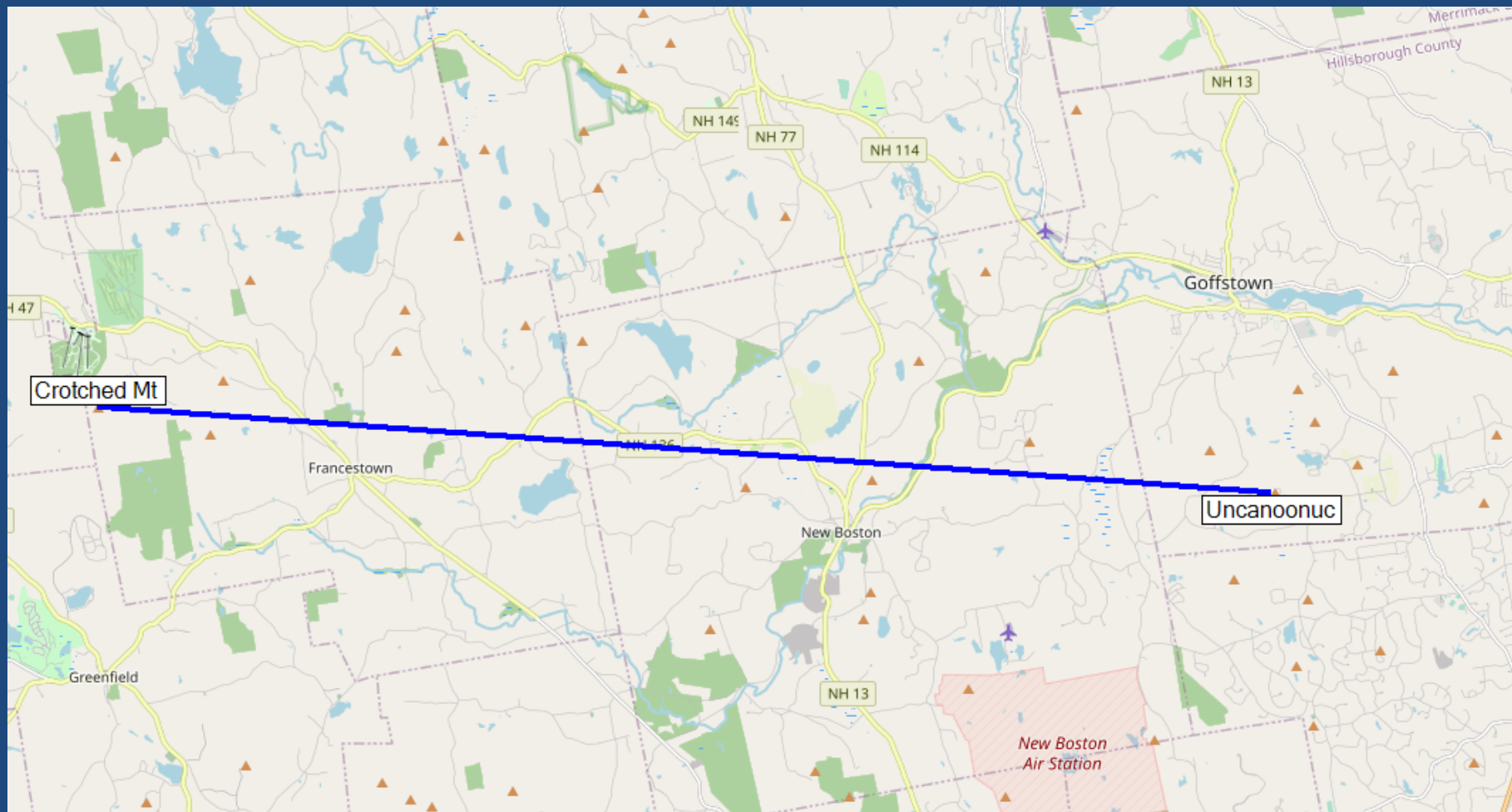
Radio Mobile Online Model Output Parameters

Crotched Mt (1)		(2) Uncanoonuc	
Latitude	42.998320 °	Latitude	42.983127 °
Longitude	-71.873831 °	Longitude	-71.589946 °
Ground elevation	621.2 m	Ground elevation	393.6 m
Antenna height	5.0 m	Antenna height	15.0 m
Azimuth	94.09 TN 108.06 MG °	Azimuth	274.28 TN 288.36 MG °
Tilt	-0.64 °	Tilt	0.43 °
Radio system		Propagation	
TX power	26.02 dBm	Free space loss	134.84 dB
TX line loss	0.10 dB	Obstruction loss	-0.68 dB
TX antenna gain	20.00 dBi	Forest loss	1.00 dB
RX antenna gain	20.00 dBi	Urban loss	0.00 dB
RX line loss	0.10 dB	Statistical loss	21.17 dB
RX sensitivity	-113.02 dBm	Total path loss	156.33 dB
Performance			
Distance			23.152 km
Precision			11.6 m
Frequency			5720.000 MHz
Equivalent Isotropically Radiated Power			39.089 W
System gain			178.84 dB
Required reliability			95.000 %
Received Signal			-90.51 dBm
Received Signal			6.68 μV
Fade Margin			22.51 dB

Design to 20dB Minimum @ 95% Reliability



Radio Mobile Online Model Output Map



**AMATEUR RADIO
EMERGENCY DATA NETWORK**

AREDN Supported Platforms arednmesh.org



Amateur Radio Emergency Data Network

Login | Register

 Search

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- CODE ▾
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- 3
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- 5

SUPPORTED PLATFORM MATRIX

DOWNLOAD

NIGHTLY BUILD

INSTALLATION

NETWORK SWITCH CONFIGS

NETGEAR SWITCHES

UBIQUITI SWITCHES

EDGEROUTER X

78	79	80	81	82	83	84	85	86	87	88	89
3.390	3.395	3.400	3.405	3.410	3.415	3.420	3.425	3.430	3.435	3.440	3.445
Shared with US non-Amateur users											

92	93	94	95	96	97	98	99
3.460	3.465	3.470	3.475	3.480	3.485	3.490	3.495
Non-US Amateurs only							

Supported Platforms

Supported Platform Matrix

The supported platform matrix identifies the make and models of hardware which may be used with AREDN firmware in the various frequency bands. The equipment marked with a green background is fully supported and tested. Models with a red background are NOT supported nor are they compatible with AREDN firmware. The orange background indicates equipment that is likely to work well, but has not yet been thoroughly tested. Equipment with a yellow background is in the research stage and may or may not achieve fully-supported status depending on test results.

In the table below, if the model is a link (**BOLD TEXT**), we've linked those to Amazon for your convenience. As an Amazon Associate AREDN, Inc. earns from qualifying purchases.

Current As of AREDN™ 3.22.8.0 (updated on 10/18/2022)

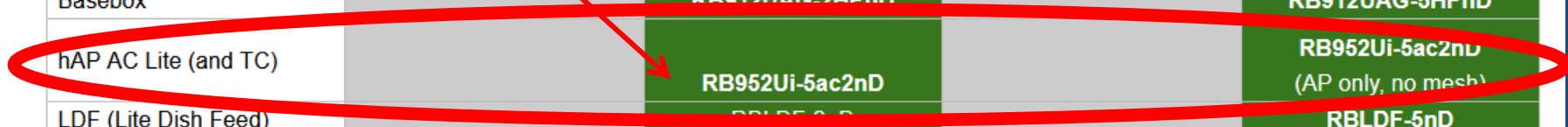
Manufacturer/Model	Band			
	900Mhz	2.4Ghz	3Ghz ⁽⁵⁾	5.8Ghz
Mikrotik (www.mikrotik.com)				
LHG (Lite Head Grid)		RBLHG-2nD		RBLHG-5nD
LHG HP/XL		RBLHG-2nD-XL		RBLHG-5HPnD-XL
LHG HP				RBLHG-5HPnD
Basebox		RB912UAG-2HPnD		RB912UAG-5HPnD
hAP AC Lite (and TC)		RB952Ui-5ac2nD		RB952Ui-5ac2nD (AP only, no mesh)
LDF (Lite Dish Feed)		RBLDF-2nD		RBLDF-5nD
QRT				RB911G-5HPnD-QRT
SXT		SXTsq-2nD		SXTsq-5nD SXTsq-5HPnD
mANTBox		RB911G-2HPnD		RB911G-5HPnD
Ubiquiti Networks (www.ubnt.com)				
AirGrid (XM revision/old)		M2		M5
AirGrid (XW)				AG-HP-5Gxx

Example: MicroTik Router Board

Current As of AREDN™ 3.22.8.0 (updated on 10/18/2022)

Manufacturer/Model	Band			
	900Mhz	2.4Ghz	3Ghz (5)	5.8Ghz
Mikrotik (www.mikrotik.com)				
LHG (Lite Head Grid)		RBLHG-2nD		RBLHG-5nD
LHG HP/XL		RBLHG-2nD-XL		RBLHG-5HPnD-XL
LHG HP				RBLHG-5HPnD
Basebox		RB912UAG-2HPnD		RB912UAG-5HPnD
hAP AC Lite (and TC)		RB952Ui-5ac2nD		RB952Ui-5ac2nD (AP only, no mesh)
LDF (Lite Dish Feed)				RBLDF-5nD
QRT				RB911G-5HPnD-QRT
SXT		SXTsq-2nD		SXTsq-5nD SXTsq-5HPnD
mANTBox		RB911G-2HPnD		RB911G-5HPnD

Click Link





Share

MikroTik hAP ac lite Dual-concurrent Access Point (RB952Ui-5ac2nD-US)

Brand: MikroTik

★★★★★ 496 ratings

| 42 answered questions

Amazon's Choice for "hap ac lite"

-6% \$48⁹³

Was: \$52.00 ⓘ

FREE Returns ▾

Get \$10 off instantly: Pay \$38.93 \$48.93 upon approval for the Amazon Prime Store Card. No annual fee.

Available at a lower price from other sellers that not offer free Prime shipping.

Brand	MikroTik
Series	HAP ac lite
Wireless Type	802.11n, 802.11b, 802.11g

AREDN Firmware Download arednmesh.org



Amateur Radio Emergency Data Network

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SUPPORTED PLATFORM MATRIX

| 14 |

DOWNLOAD



NIGHTLY BUILD

INSTALLATION

NETWORK SWITCH CONFIGS

NETGEAR SWITCHES

UBIQUITI SWITCHES

EDGEROUTER X

78	79	80	81	82	83	84	85	86	87	88	89
3.390	3.395	3.400	3.405	3.410	3.415	3.420	3.425	3.430	3.435	3.440	3.445

Shared with US non-Amateur users

92	93	94	95	96	97	98	99
3.460	3.465	3.470	3.475	3.480	3.485	3.490	3.495

Non-US Amateurs only

Go To Download Page

The current AREDN software is available here



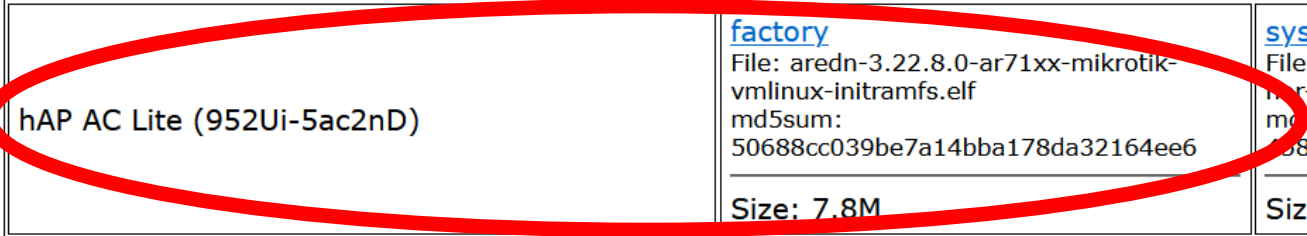
Installation Instructions

Firmware for MicroTik Router Board

Latest Stable version is: **3.22.8.0**

STEP 1: Find your device/model from this column.

STEP 2: Choose either the **FACTORY or **SYSUPGRADE** file from these columns**

AREDN™ Firmware for Mikrotik	NOT Loading from AREDN UI	Loading from AREDN UI
Basebox 2 (RB912UAG-2HPnD) Basebox 5 (RB912UAG-5HPnD) QRT 5 (RB911G-5HPnD-QRT) mAntbox 2 (RB911G-2HPnD) mAntbox 5 (RB911G-5HPnD)	factory File: aredn-3.22.8.0-ar71xx-mikrotik-vmlinux-initramfs.elf md5sum: 50688cc039be7a14bba178da32164ee6 <hr/> Size: 7.8M	sysupgrade File: aredn-3.22.8.0-ar71xx-mikrotik-nand-large-squashfs-sysupgrade.bin md5sum: eba80ad80b5ba26681d82a3fc3062702 <hr/> Size: 5.3M
 hAP AC Lite (952Ui-5ac2nD)	factory File: aredn-3.22.8.0-ar71xx-mikrotik-vmlinux-initramfs.elf md5sum: 50688cc039be7a14bba178da32164ee6 <hr/> Size: 7.8M	sysupgrade File: aredn-3.22.8.0-ar71xx-mikrotik-rb-nor-flash-16M-ac-squashfs-sysupgrade.bin md5sum: 8d449fdb608445e04669de0f40707d <hr/> Size: 5.2M
Lite Head Grid 2 (RBLHG-2nD) Lite Head Grid 5 (RBLHG-5nD) Lite Head Grid 5HP (RBLHG-5HPnD) Lite Head Grid 2XL (RBLHG-2nD-XL) Lite Head Grid 5HPXL (RBLHG-5HPnD-XL) Lite Dish Feed 2 (LDF-2nD) Lite Dish Feed 5 (LDF-5nD) SXTsq 5HP (RBSXTsq-5HPnD) SXTsq 5 (RBSXTsq-5nD) SXTsq 2 (RBSXTsq-2nD)	factory File: aredn-3.22.8.0-ar71xx-mikrotik-vmlinux-initramfs.elf md5sum: 50688cc039be7a14bba178da32164ee6 <hr/> Size: 7.8M	sysupgrade File: aredn-3.22.8.0-ar71xx-mikrotik-rb-nor-flash-16M-squashfs-sysupgrade.bin md5sum: 790a7db49eed261cc07666c6939d232d <hr/> Size: 5.2M

Install on MicroTik RouterBoard

The current AREDN software is available here



Installation Instructions

Mikrotik Devices

1. If you have an earlier version of AREDN firmware on this device, use the user interface (UI) on the Administration page under Setup. Use the correct sysupgrade file.
2. If you are installing AREDN firmware on a new device, use the [special Mikrotik method to install AREDN firmware](#). Use the correct factory (ELF) file initially, then, the correct bin (sysupgrade) file.

MicroTik YouTube Instructions

<https://www.youtube.com/watch?v=7ltUHqG4A7Q>

The screenshot shows a YouTube video player displaying a webpage from the Amateur Radio Emergency Data Network (AREDN). The webpage has a navigation menu with links for HOME, SOFTWARE, DOCS, FORUM, MAP, ABOUT US, CODE, SHOP, and DONATE. The main content area is titled "Nightly Builds" and contains the following text:

Nightly Builds

Here is where you can find the latest versions of AREDN Firmware. Remember that these versions may have instabilities or bugs. Our progress depends on community feedback, so please report all your results, both positive and negative, from using a nightly build.

Before downloading and installing a nightly build, please read the README and CHANGELOG files. We cannot emphasize this too much.

The README file is here.

The CHANGELOG file is here.

Ubiquiti Firmware is here. Look for files with "ubnt" in the file name.

TP-Link firmware is here Look for files with "cpe210-220" or "cpe510-520" in the file name.

Mikrotik firmware is here Look for files with "mikrotik" in the file name.

Powered by Drupal

Theme by Danieloff and Daniel Price Based on inspired by Nostromo

The video player interface includes a search bar at the top, a browser address bar showing the URL <https://www.arednmesh.org/content/nightly-builds>, and a video control bar at the bottom with a play button, volume icon, and a progress indicator showing 0:07 / 20:40. A "powered by Screencastify" logo is visible in the top right corner of the video frame.

Installing AREDN Firmware on Mikrotik Device with Windows

Required Installation Software

<http://reboot.pro/files/file/303-tiny-pxe-server/>

NODE CONFIGURATION

Node Status Screen

Type localnode:8080 in a browser



Router name must include callsign and be unique.
Callsign, Location, Node Function

K1EHZ-Bedford6-NH-TUN

Location: 42.965204 -71.584661

WAN Tunnel node for 5GHz mesh in Bedford, NH.
Mikrotik RB952Ui-5ac2nD-US.

[Help](#)

Refresh

Mesh Status

Neighbor Status

Setup

Select a theme ▼

Primary address	10.45.20.59 / 8	firmware version	3.22.8.0
LAN address	10.162.135.97 / 27	model	MikroTik RouterBOARD RB952Ui-5ac2nD
WAN address	192.168.1.13 / 24	system time	Sun Nov 6 2022 17:32:41 UTC
default gateway	192.168.1.1	uptime	31 days, 7:22
		load average	1.34, 0.98, 0.94
		free space	flash = 10316 KB /tmp = 29848 KB memory = 11184 KB
		OLSR Entries	Total = 123 Nodes = 32

Mesh Status Screen

Why naming is important

K1EHZ-Bedford6-NH-TUN

- pi4
- Citadel

[GMMeshChat-1751](#)
Tunnel Server
WiFi Access Point
Tunnel Client
[IperfSpeed](#)

[NE Mesh Map](#)
[Citadel](#)

Remote Nodes

ETX

Services

[W1WDT-Woodmont1-CT-TUN](#)

0.20

Tunnel Client
Tunnel Server

[K1EHZ-Uncanoonuc2-NH-NAS](#)

0.20

[IperfSpeed](#)

[N1KWG-Elliot1-NH-Omni](#)

0.20

[KD2BEC-Nashua1-NH-TUN](#) (tun*2,wan)

0.20

[GMMeshChat-1751](#)
[network-graph](#)

- KD2BEC-Server1

[KB1OTI-AUBURN-NH-TUN](#) (tun*1)

0.20

[IperfSpeed](#)

[K9AEN-Nashua1-NH-TUN](#) (tun*1)

0.20

[GMMeshChat-1751](#)
[IperfSpeed](#)
Tunnel Client

[K1EHZ-Uncanoonuc3-NH-EHS](#)

0.20

[KC1KMM-Manchester1-NH-TUN](#) (tun*1)

0.20

- CAM

[CAM](#)

[NG1P-Topsham2-ME](#) (wan)

0.20

[W1EAA-Goffstown1-NH-TUN](#) (tun*1)

0.20

[GMMeshChat-1751](#)
[IperfSpeed](#)
Tunnel Client

[KA1IJN-Elliot2-NH-EOC](#)

0.20

[IperfSpeed](#)

[K1EHZ-Elliot5-NH-UNC](#)

0.20

[IperfSpeed](#)

[K1EHZ-Uncanoonuc1-NH-CRT](#)

0.20

[IperfSpeed](#)

[K1EHZ-Bedford2-NH-AP](#) (dtd)

100% 100%

WiFi Access Point

[K1EHZ-Elliot4-NH-TUN](#) (tun,wan)

100% 100%

- S305-RR-Phone
- FreePBX
- k1ehz-ntp
- GMARES-TeamTalk

[K1EHZ-Uncanoonuc4-NH-TUN](#) (tun,wan)

100% 100%

[K1UI-Yarmouthport1-MA-TUN](#) (tun)

100% 100%

[N1KWG-Auburn1-NH-TUN](#) (tun,wan)

100% 100%

- Base-Phone
- Mobile-Phone

[NE1B-Hudson1-NH-TUN](#) (tun)

100% 100%

[NG1P-Topsham1-ME-TUN](#) (tun,wan)

100% 100%

- NG1P-BPQ-Node

GMARES-TeamTalk
Winlink Mesh PO 10.23.162.83

[IperfSpeed](#)

[GMMeshChat-1751](#)

[IperfSpeed](#)

[GMMeshChat-1751](#)

[IperfSpeed](#)

[GMMeshChat-1751](#)

[IperfSpeed](#)

Tunnel Server

[Cacti login=ham_password=ham](#)
[TeamTalk \(VOIP\)](#)

[BPQ Packet \(ask for a login\)](#)

Previous Neighbors

When

none

OLSR Entries

Total 123

Nodes 32

Router Node Configuration



K1EHZ-Bedford6-NH-TUN

Location for mapping \longrightarrow Location: 42.965204 -71.584661

WAN Tunnel node for 5GHz mesh in Bedford, NH.
Mikrotik RB952Ui-5ac2nD-US.

[Help](#)

Refresh

Mesh Status

Neighbor Status

Setup

Select a theme \downarrow

Primary address 10.45.20.59 / 8

LAN address 10.162.135.97 / 27

WAN address 192.168.1.13 / 24

default gateway 192.168.1.1

firmware version 3.22.8.0

model MikroTik RouterBOARD RB952Ui-5ac2nD

system time Sun Nov 6 2022 17:32:41 UTC

uptime 31 days, 7:22

load average 1.34, 0.98, 0.94

free space flash = 10316 KB

/tmp = 29848 KB

memory = 11184 KB

OLSR Entries Total = 123

Nodes = 32

Router Node Configuration



K1EHZ-Bedford6-NH-TUN

Location: 42.965204 -71.584661

WAN Tunnel node for 5GHz mesh in Bedford, NH.
Mikrotik RB952Ui-5ac2nD-US.


[Help](#)

Refresh

Mesh Status

Neighbor Status

Setup

Select a theme 

Primary address 10.45.20.59 / 8

LAN address 10.162.135.97 / 27

WAN address 192.168.1.13 / 24

default gateway 192.168.1.1

firmware version 3.22.8.0

model MikroTik RouterBOARD RB952Ui-5ac2nD

system time Sun Nov 6 2022 17:32:41 UTC

uptime 31 days, 7:22

load average 1.34, 0.98, 0.94

free space flash = 10316 KB

/tmp = 29848 KB

memory = 11184 KB

OLSR Entries Total = 123

Nodes = 32

Basic Setup for a MicroTik Router Board

[Node Status](#) **Basic Setup** [Port Forwarding, DHCP, and Services](#) [Tunnel Server](#) [Tunnel Client](#) [Administration](#) [Advanced Configuration](#)

[Help](#) [Save Changes](#) [Reset Values](#) [Default Values](#) [Reboot](#)

Node Name Password

Node Description (optional) Verify Password

Mesh RF (2GHz)	LAN	WAN
Enable <input type="checkbox"/>	LAN Mode <input type="text" value="29 host Direct"/> ?	Protocol <input type="text" value="Static"/>
IP Address <input type="text" value="10.45.20.59"/>	IP Address <input type="text" value="10.162.135.97"/>	IP Address <input type="text" value="192.168.1.13"/>
Netmask <input type="text" value="255.0.0.0"/>	Netmask <input type="text" value="255.255.255.224"/>	Netmask <input type="text" value="255.255.255.0"/>
	DHCP Server <input checked="" type="checkbox"/>	Gateway <input type="text" value="192.168.1.1"/>
	DHCP Start <input type="text" value="98"/>	DNS 1 <input type="text" value="8.8.8.8"/>
	DHCP End <input type="text" value="126"/>	DNS 2 <input type="text" value="8.8.4.4"/>
	LAN Access Point	WAN Wifi Client
	Enable <input checked="" type="checkbox"/> ?	Enable <input type="checkbox"/> ?
	AP band <input type="text" value="5GHz"/>	SSID <input type="text" value="K1EHZ-WAN2"/>
	SSID <input type="text" value="K1EHZ-Tunnel-6"/>	Password <input type="password"/>
	Channel <input type="text" value="36"/>	
	Encryption <input type="text" value="WPA2 PSK"/>	
	Password <input type="password"/>	

Optional Settings

Latitude [Find Me!](#) [Apply Location Settings](#) [Show Map](#) [Upload data to AREDN Servers](#)

Longitude Grid Square

Internet Tunneling for Training and Maintenance

Get Tunnel Client Info from Tunnel Server Owner

Must have an internet connection

[Node Status](#) [Basic Setup](#) [Port Forwarding, DHCP, and Services](#) [Tunnel Server](#) **Tunnel Client** [Administration](#) [Advanced Configuration](#)

[Help](#)

Save Changes

Reset Values

Refresh

Connect this node to the following servers:

Enabled?	Server	Pwd	Network	Active	Action
<input checked="" type="checkbox"/>	XXXXXXXXXXXXXXXX	XXXXXX	XXXXXXXXXX		Del
Contact Info/Comment (Optional): <input type="text"/>					
<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		Add
Contact Info/Comment (Optional): <input type="text"/>					

Services on Node

[Node Status](#)

[Basic Setup](#)

**Port Forwarding,
DHCP, and Services**

[Tunnel
Server](#)

[Tunnel
Client](#)

[Administration](#)

[Advanced
Configuration](#)

[Help](#)

Save Changes

Reset Values

Refresh

DHCP Address Reservations

Hostname	IP Address	MAC Address	Do Not Propagate	
pi4	10.162.135.99	dc:a6:32:09:a1:df	<input type="checkbox"/>	Del
Citadel	10.162.135.117	a4:ba:db:eb:ff:dc	<input type="checkbox"/>	Del
	- IP Address -		<input type="checkbox"/>	Add

Current DHCP Leases

Citadel	10.162.135.117	a4:ba:db:eb:ff:dc	Add
---------	----------------	-------------------	-----

Advertised Services

Name	Link	URL								
Tunnel Se	<input type="checkbox"/>	:://	K1EHZ-Bedford6-NH-TUN	▼	:		/		Del	
WiFi Acce	<input type="checkbox"/>	:://	K1EHZ-Bedford6-NH-TUN	▼	:		/		Del	
Tunnel Cli	<input type="checkbox"/>	:://	K1EHZ-Bedford6-NH-TUN	▼	:		/		Del	
GMMeshC	<input checked="" type="checkbox"/>	http	:://	K1EHZ-Bedford6-NH-TUN	▼	:	8080	/	meshchat	Del
IperfSpee	<input checked="" type="checkbox"/>	http	:://	K1EHZ-Bedford6-NH-TUN	▼	:	8080	/	iperfspeec	Del
Citadel	<input checked="" type="checkbox"/>	http	:://	Citadel	▼	:	80	/		Del
NE Mesh P	<input checked="" type="checkbox"/>	http	:://	Citadel	▼	:	12326	/	map_displ	Del
	<input type="checkbox"/>	:://	K1EHZ-Bedford6-NH-TUN	▼	:		/		Add	

Port Forwarding

Interface	Type	Outside Port	LAN IP	LAN Port	
WAN	TCP	5525	localhost	5525	Del
WAN	TCP		- IP Address -		Add

DNS Aliases

Alias Name	IP Address	
	- IP Address -	Add

Services on Node Mesh Status Screen

Local Hosts

K1EHZ-Bedford6-NH-TUN

- pi4
- Citadel

Services

[GMMeshChat-1751](#)

Tunnel Server

WiFi Access Point

Tunnel Client

[IperfSpeed](#)

[Citadel Email](#)

[NE Mesh Map](#)

**Click on Red Links
to access with browser**

Services on Node

CHAT FILES STATUS LOGOUT

Mesh Chat v2.0

Zone: GMMeshChat-1751
Call Sign: K1EHZ

Node: K1EHZ-Bedford6-NH-TUN
Updated: 14 seconds ago

Send a Message

New Message

Enter message here

Channel: Everything ▼

SEND

Mesh Chat Users 0

Call Sign	Node	Last Seen
-----------	------	-----------

Messages

Search:

Channel: Everything ▼

Time	Message	Call Sign	Channel	Node
10/30/22 5:53 PM	Will leave router up for now. Was able to use Apple iPad and Safari browser.	K1UI		K1UI-Yarmouthport 1-MA-TUN

Services on Node

Run a Iperf Speed Test

Server:

K1EHZ-Bedford6-NH-TUN



Client:

K1EHZ-Crotched1-NH-UNC



Test Results

Starting iperf server

iperf server started

Starting iperf client

Connecting to host K1EHZ-Bedford6-NH-TUN, port 5201

[5] local 10.208.238.212 port 42730 connected to 10.45.20.59 port 5201


[ID]	Interval		Transfer	Bitrate	Retr	Cwnd
[5]	0.00-1.00	sec	362 KBytes	2.96 Mbits/sec	0	36.9 KBytes
[5]	1.00-2.00	sec	303 KBytes	2.48 Mbits/sec	0	42.3 KBytes
[5]	2.00-3.00	sec	343 KBytes	2.81 Mbits/sec	0	45.1 KBytes
[5]	3.00-4.00	sec	395 KBytes	3.23 Mbits/sec	0	49.1 KBytes
[5]	4.00-5.00	sec	397 KBytes	3.25 Mbits/sec	0	69.6 KBytes
[5]	5.00-6.00	sec	496 KBytes	4.06 Mbits/sec	0	104 KBytes
[5]	6.00-7.00	sec	498 KBytes	4.08 Mbits/sec	0	169 KBytes
[5]	7.00-8.00	sec	620 KBytes	5.08 Mbits/sec	0	169 KBytes
[5]	8.00-9.00	sec	489 KBytes	4.00 Mbits/sec	0	276 KBytes
[5]	9.00-10.00	sec	628 KBytes	5.14 Mbits/sec	0	276 KBytes

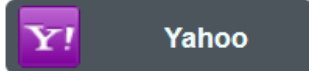
[ID]	Interval		Transfer	Bitrate	Retr	
[5]	0.00-10.00	sec	4.42 MBytes	3.71 Mbits/sec	0	sender
[5]	0.00-10.06	sec	4.22 MBytes	3.52 Mbits/sec		receiver

Services on Node Citadel Email

Citadel Server - powered by Citadel

You must be logged in to access this page.

Close window 



Log in using a user name and password

User name:

Password:

Log in

New user? Register now

Services on Node

Streaming Video

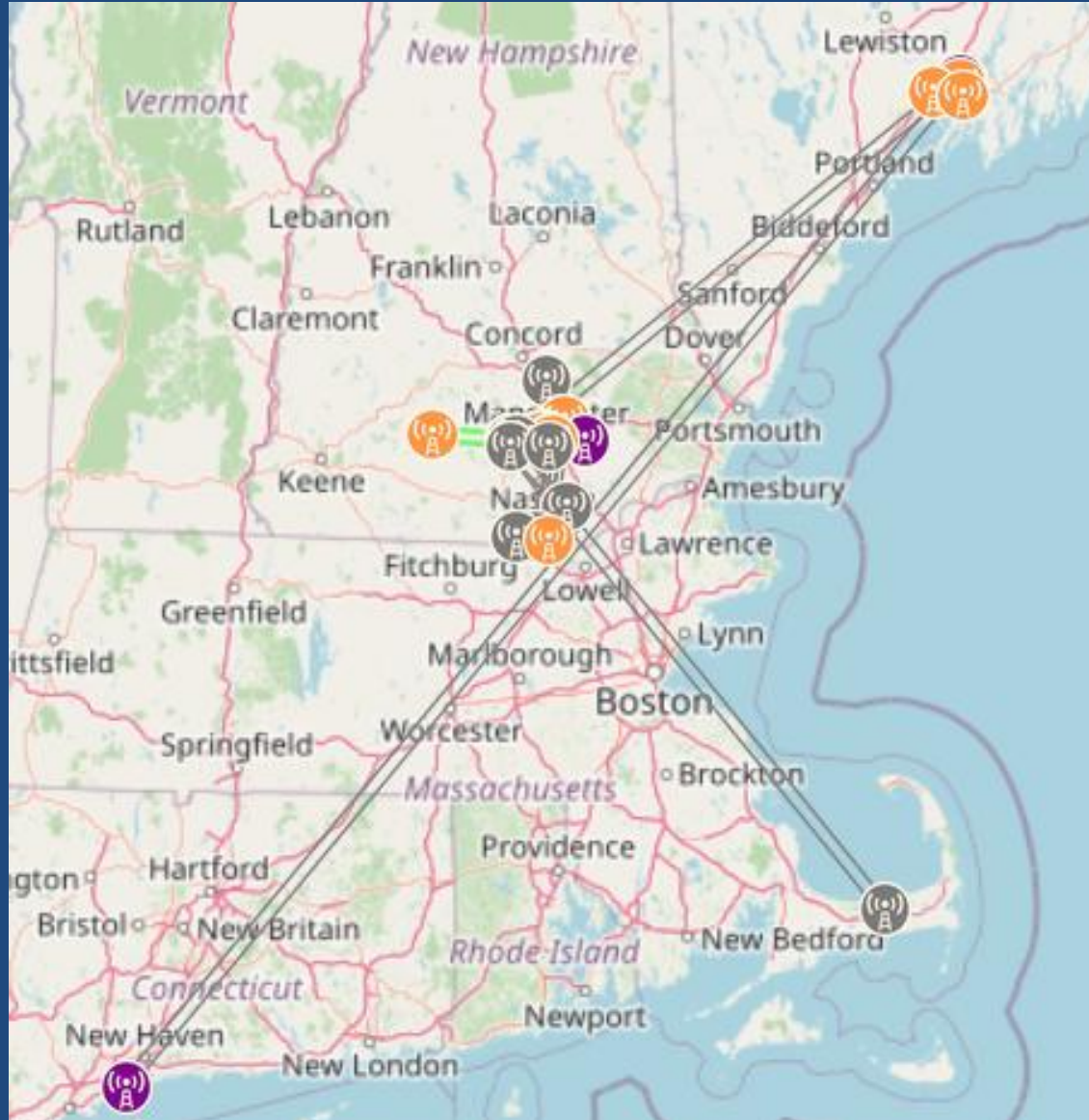
Current Neighbors	LQ	NLQ	TxMbps	Services
<u>K1EHZ-Bedford1-NH</u> <ul style="list-style-type: none">● K1EHZ-Video-Camera1● VHF-GoKit● HF-GoKit	100%	100%	21.7	<u>IperfSpeed</u> <u>K1EHZ Video Camera1</u> user01 = name & password Connect using NoMachine Connect with NoMachine
<u>K1EHZ-Bedford6-NH-TUN</u> (dtd) <ul style="list-style-type: none">● Citadel	100%	100%		<u>GMMeshChat-1751</u> Tunnel Server WiFi Access Point Tunnel Client <u>IperfSpeed</u> <u>Citadel Email</u> <u>NE Mesh Map</u>

Services on Node Streaming Video

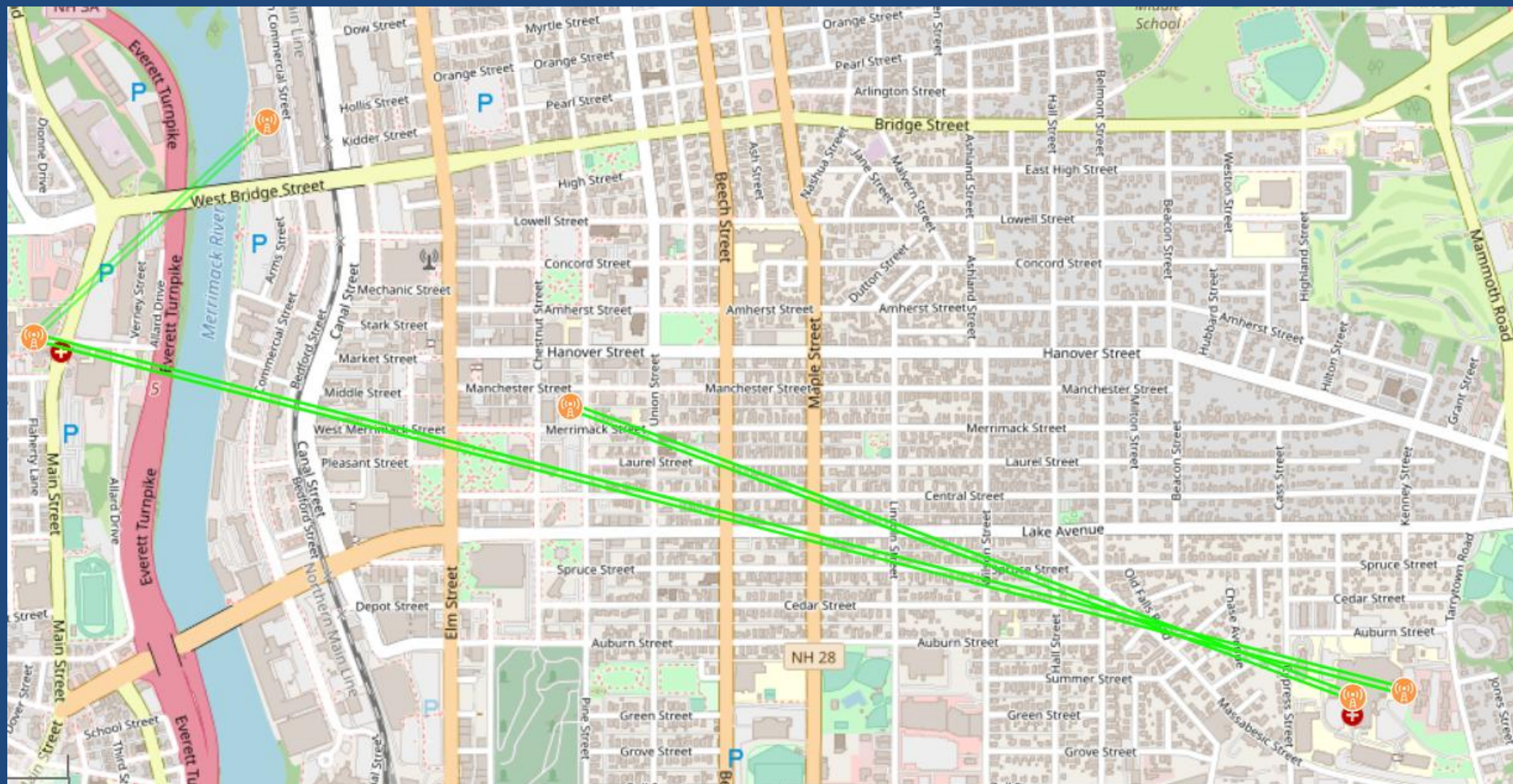
The image shows a video player interface for a live stream. At the top, there are two tabs: "Preview" (selected) and "Playback". The "reolink" logo is visible in the top right corner. Below the tabs, the channel name "CH 1 - Fluent" is displayed on the left, and a set of icons (full screen, zoom in, zoom out) is on the right. The main video area shows a live stream of a golf course with trees and a stone wall in the foreground. A timestamp "37:25:17.062 13:24:24 MON" is overlaid on the video. The text "Camera 1" is visible in the bottom right corner of the video frame. At the bottom of the player, there are playback controls: a play button, a stop button, a volume slider, and a mute icon.

Services on Node

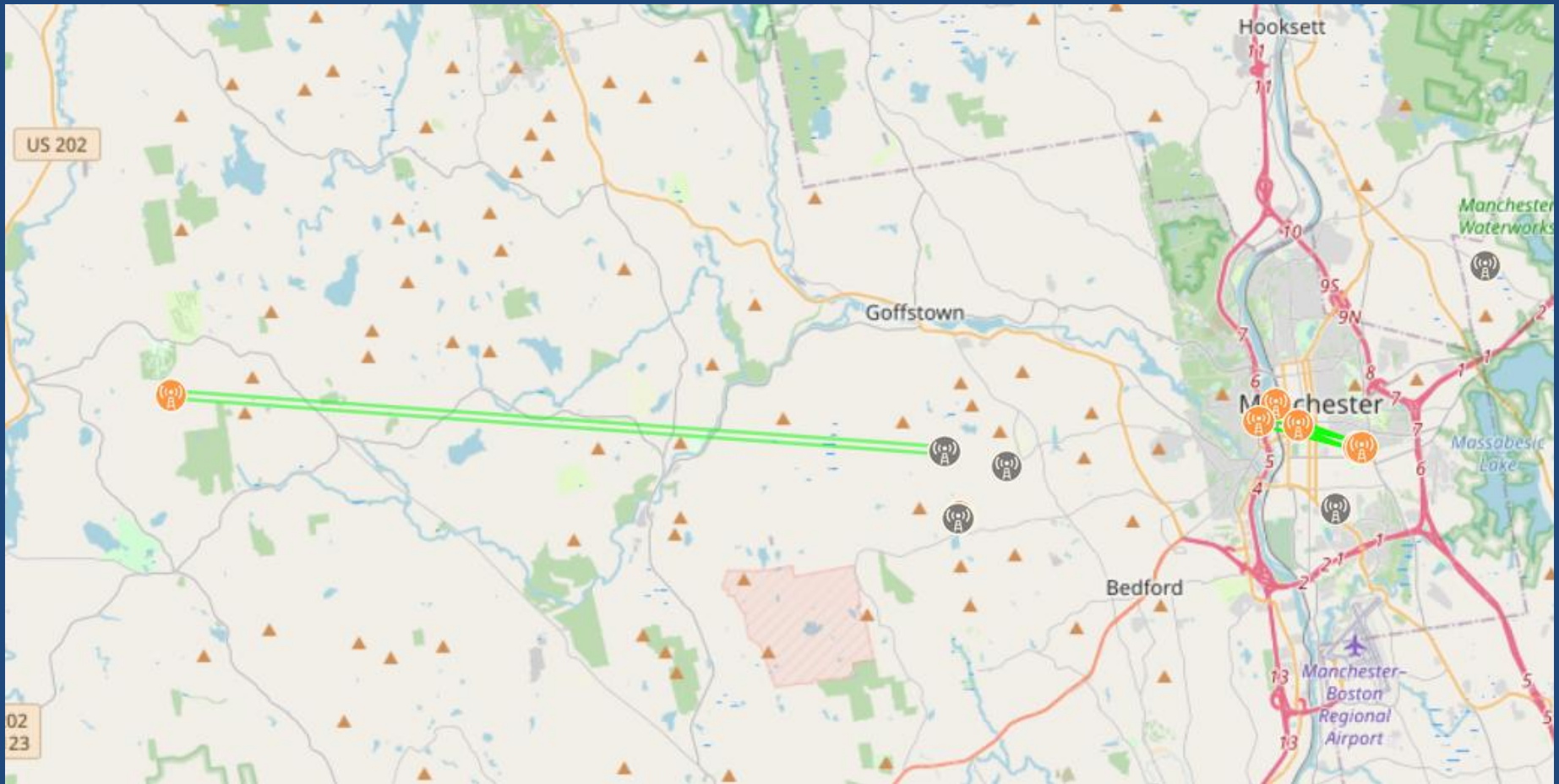
Mesh Map of Our Network



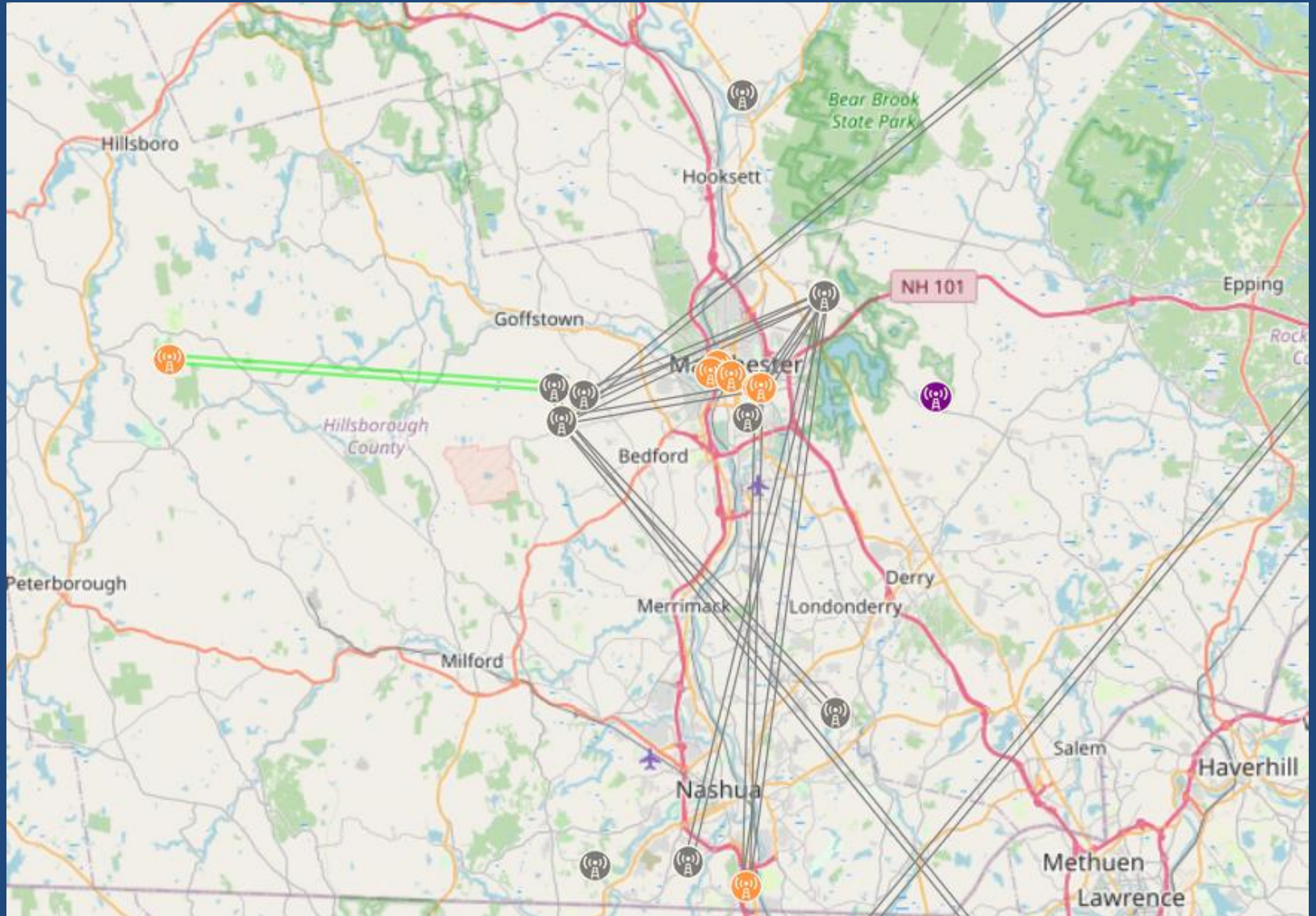
Manchester Mesh Network



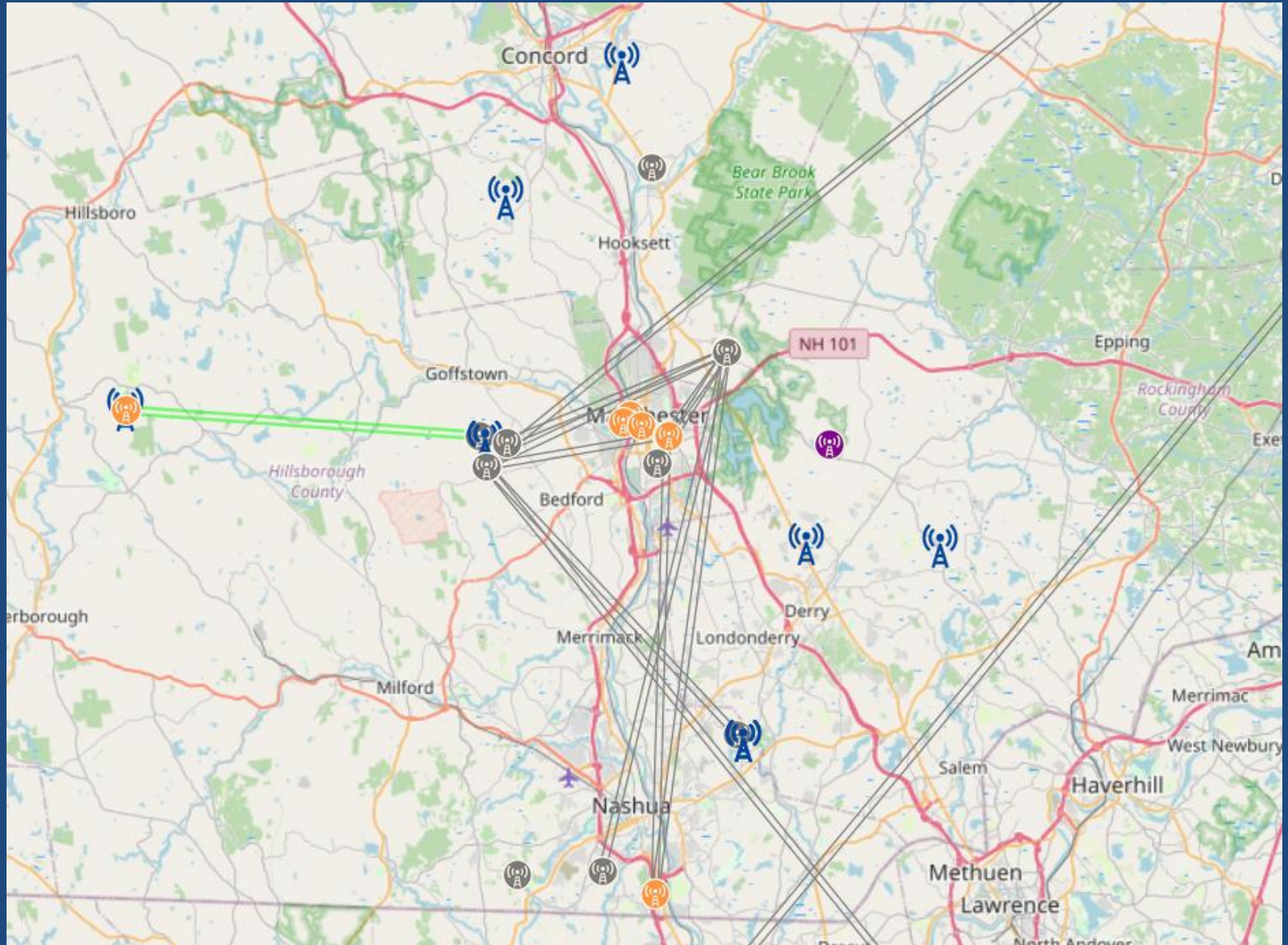
Crotched – Uncanoonuc Link



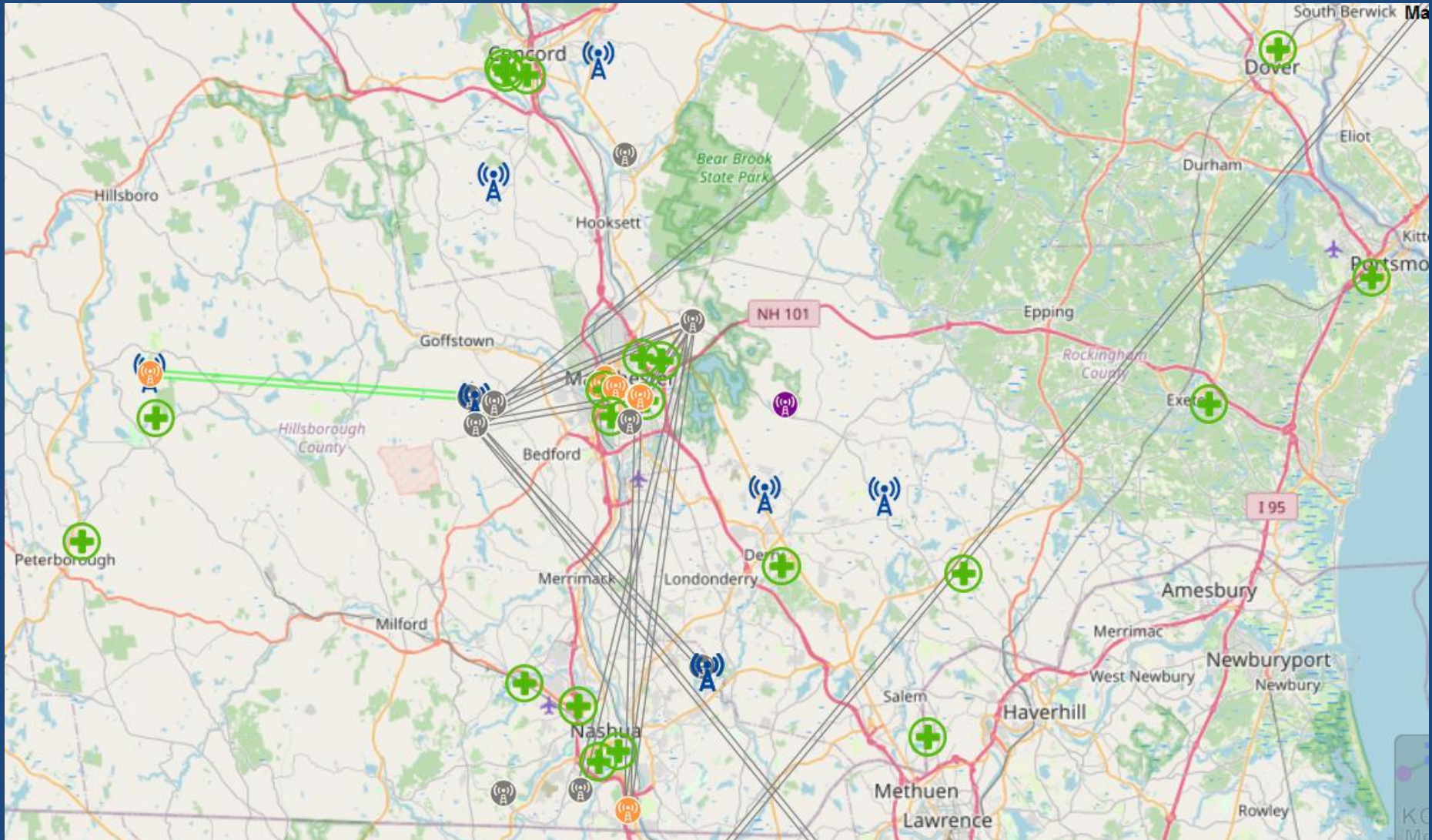
Mesh Network Internet Tunnels



Add DMR Repeater



Add Hospitals



Remote Computer

Mini PC-type Windows Computer (12v)



Beelink T4 Pro Mini PC, Celeron N3350 up to 2.4GHz Mini Computer, Mini Desktop Computer 4GB DDR +64GB, Small Computer PC Supports Dual HDMI, 4 USB 3.0, 2.4G+5.8G WiFi, BT4.0

[Visit the Beelink Store](#)



292 ratings | 65 answered questions

Amazon's Choice

in Mini Computers by Beelink

\$139⁰⁰



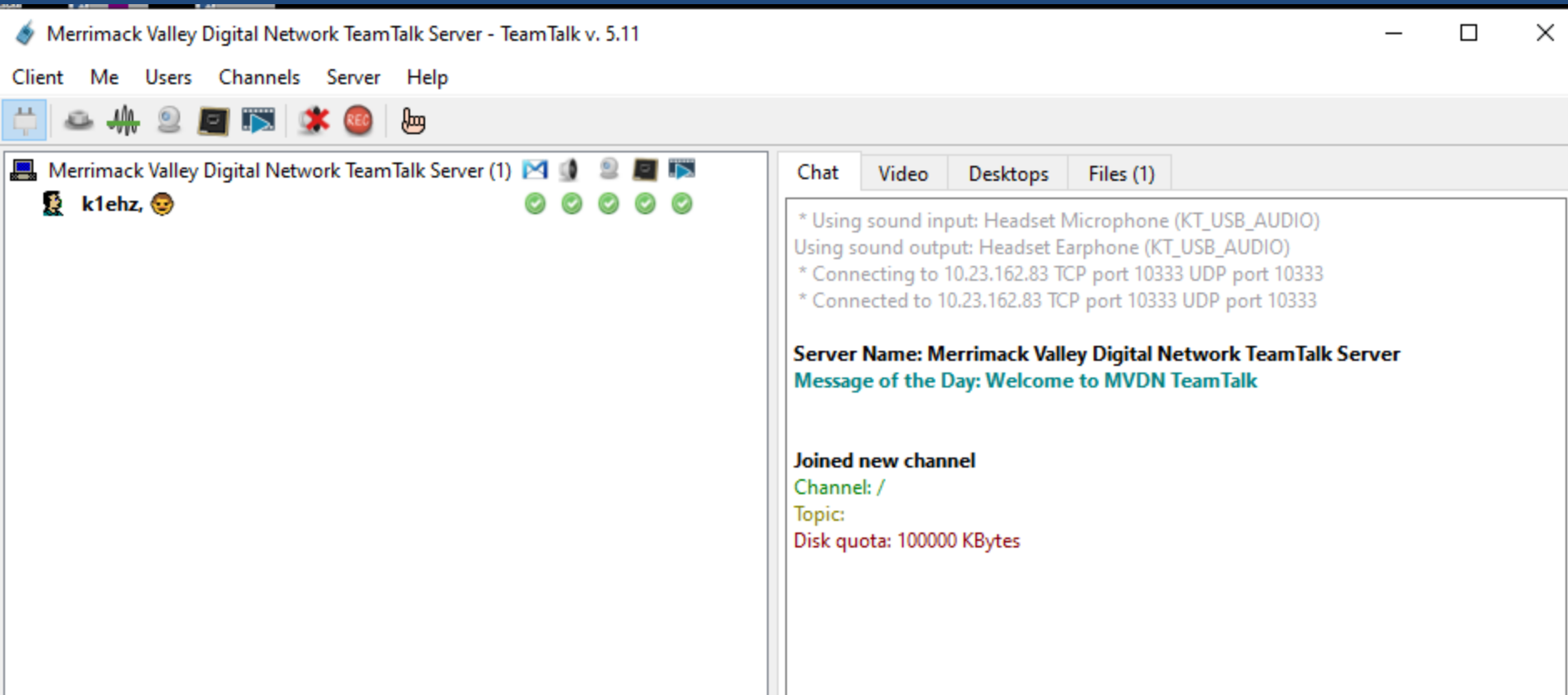
TeamTalk Conferencing Program

https://bearware.dk/?page_id=353

- Server runs on Windows mini computer
- Access with app on computer, tablet, smartphone
- Audio and video conferencing
- Share desktop applications
- Share files
- Single channel or separate channels for different groups or functions

TeamTalk Conferencing Program

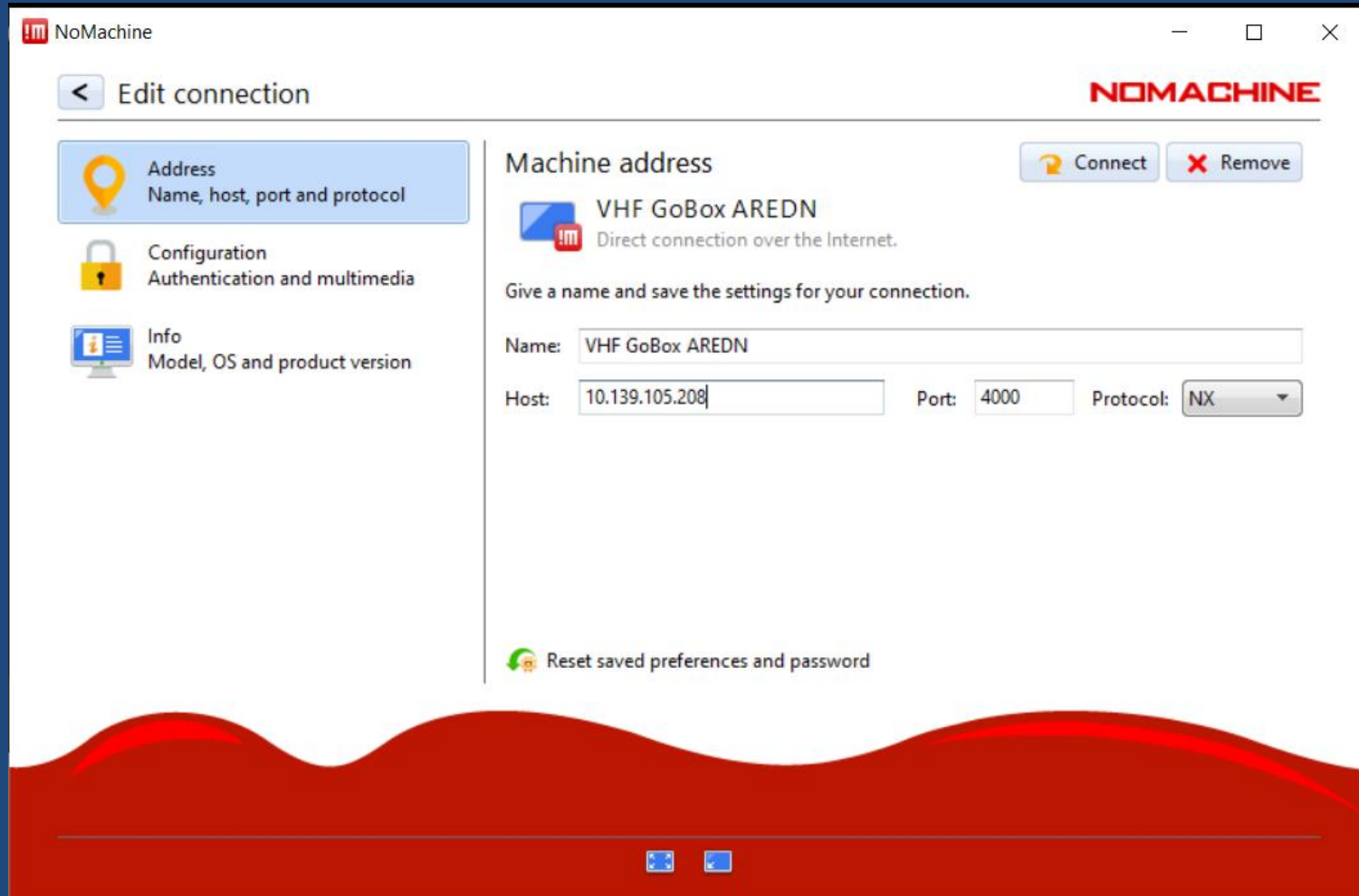
Apps for computer, tablet, smartphone



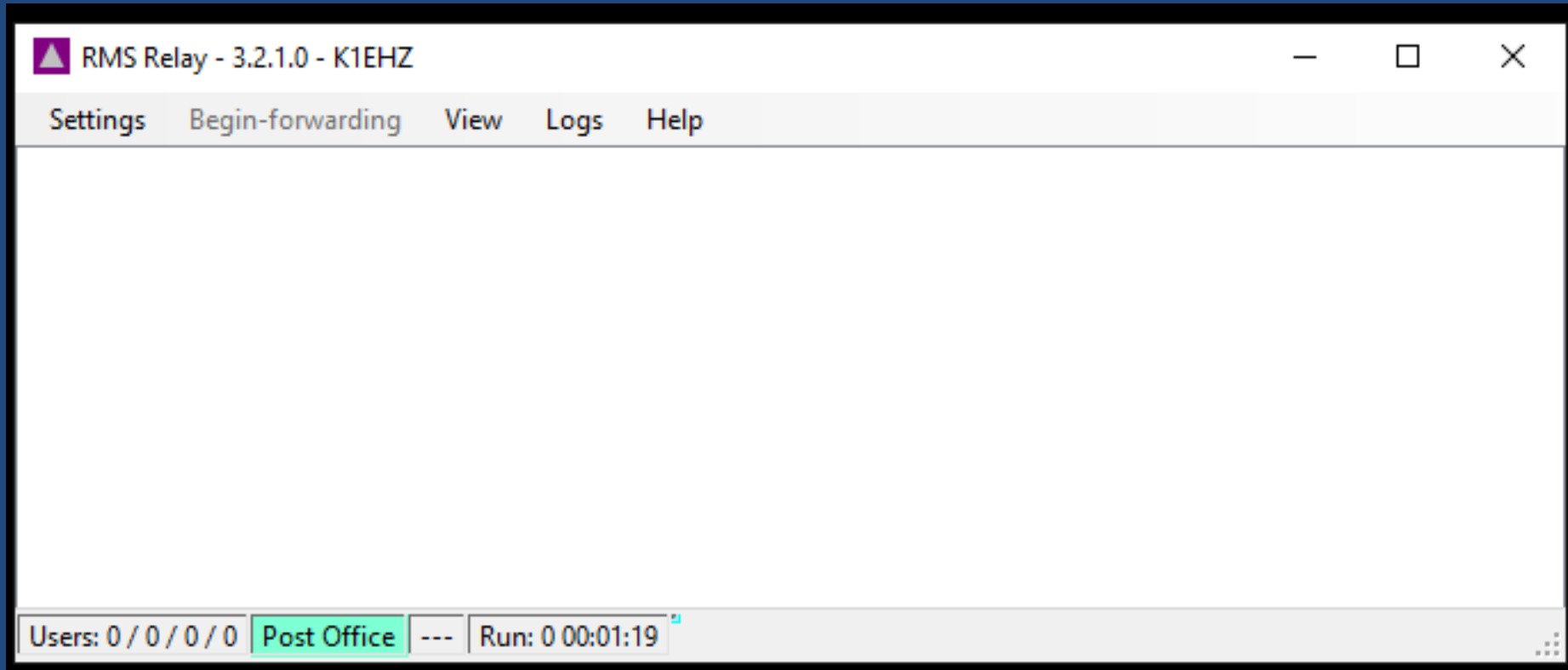
Remote Computer Operation

NoMachine (P2P, no internet needed)

<https://www.nomachine.com/>



Winlink Local Post Office on Windows Mini Computer



Remote Computer Operation HF GoBox

The screenshot displays the fldigi ver4.1.20 software interface for user K1EHZ. The main window features a menu bar (File, Op Mode, Configure, View, Logbook, Help) and a toolbar with buttons for Spot, RxID, TxID, and TUNE. The central display shows a large frequency readout of 3582.000. Below this are fields for Freq (3583.501), Call, and Qth. A control panel contains buttons for Clear RX, Clear TX, Call de MyCall, Relay Call, Stby FLamp, Stby FLmsg, THOR-22, THOR-50X1, Rx, and TX. A second row of buttons includes CI with TFC, CI w/o TFC, Call Snd Msg, de K1EHZ, Stby KMHT WX, KMHT WX, PSK-250R, MF5K-32, MT63-1KL, and Save Macros. A third row includes DE NNB1FD, Test NNB1FD, CI NNB1FD, RRR Dig Msg, DE NNA1FD, Test NNA1FD, CI NNA1FD, RRR Dig Msg, MT63-1KL, THOR22, Save Macros, and Clear RX. The main text area shows macro loading information: "Read macros from: C:\Users\K1EHZ\fldigi.files\macros\NHDN macros.mdf", "Loaded macros: C:\Users\K1EHZ\fldigi.files\macros\HC-ARES-VHF-UHF-Macros-EOC-V09E12-K1EHZ.mdf", and "Loaded macros: C:\Users\K1EHZ\fldigi.files\macros\NHDN macros.mdf". The bottom section features a waterfall plot with a frequency scale from 500 to 2500. The plot shows a blue background with a red vertical line at 1501 and a yellow vertical line at 1501. The control panel at the bottom includes buttons for WF, -10, 70, x2, NORM, 1501, QSY, Store, Lk, T/R, THOR22, s/n -16 dB, FEC: 0%, a signal strength indicator (-120 to -20), and a SQL button.

Remote Computer Operation HF GoBox

The image displays two overlapping software windows. The top window is Winlink Express 1.7.2.1, showing an email interface for K1EHZ. The bottom window is VARA HF v4.6.3, showing a waterfall plot, a menu, and various status gauges.

Winlink Express 1.7.2.1 - K1EHZ

Message List:

System Folders	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
Inbox (0 unread)	2022/10/09 18:48	5YT8F3T90692	1597	KB1TCE	KB1TCE	KC1ILT...	Weekly Winlink Message Number 256
Read Items (0)	2022/10/07 19:50	E2ZKBDNRNGJI6	1065	W4AKH	W4AKH	K1EHZ	Jay, FL WL Net Check in Reminder
Outbox (0)	2022/10/07 01:47	8SOZ494565LE	590	K1CFI	K1CFI	K1EHZ	Off the air for WinLink???
Sent Items (86)							
Saved Items (171)							

VARA HF v4.6.3 K1EHZ

Menu: Settings, View, Log*, Monitor, Help, Upgrade

Channel: W1AW, Center Freq. (kHz): 7058.500

Status: Channel Busy In: 0/0 Out: 0/0 BPM: 0/0 Connected to W1AW

Log: *** Winlink Vara Connection to W1AW @ 2022/11/07 18:47:18 USB Di...
*** Station Bearing: 213, Range: 103 miles
RMS Trimode 1.3.47.0
K1EHZ has 120 daily minutes remaining with W1AW (FN31PR)
(SFI = 131 On 2022-11-07 17:00 UTC)

Waterfall Plot: Shows signal activity in bps (0-90) over time.

Gauges: VU (Audio Input: 14 dBFS), CPU (%CPU not available), AFC (AFC: 0.0 Hz), S/N (S/N (3500 Hz): +12.6 dB)

Buttons: DATA, ACK, IDLE, NACK, BREAK, REQ, QRT

Status Bar: RX, K1EHZ ↔ W1AW, (4) 88 bps, 129 Bytes, 500 LISTEN, TOP, BUSY

Remote Computer Operation

VHF GoBox

The screenshot displays the fldigi ver4.1.20 software interface for K1EHZ. The main window title is "fldigi ver4.1.20 - K1EHZ". The interface includes a menu bar (File, Op Mode, Configure, View, Logbook, Help) and a toolbar with buttons for Spot, RxID, TxID, and TUNE. The frequency display shows 145730.000. Below the frequency display is a control panel with various buttons and fields for frequency, call, and other parameters. A macro table is visible, listing various macros such as "Clear RX", "Clear TX", "Relay Checkin", "Send Ur Msg", "Nothing Heard ...", "QTH CI", "Any Business?", "NCS ACK CALL", "Any Relays?", "NCS ID", "NCS TX", "Stby FLAMP", "Good Copy", "Save Macros", "Check List", "Left Click - execute", and "Right Click - edit". The interface also shows a large yellow area with text indicating that macros were read from a file: "Read macros from: C:\Users\K1EHZ\fldigi.files\macros\HC-ARES-VHF-UHF-Macros-EOC-V09E12-Block-Format.mdf". At the bottom, there is a spectrum display showing a blue signal on a black background, with a frequency scale from 500 to 2500. The bottom toolbar includes buttons for WF, -11, 70, x2, NORM, 1500, QSY, Store, Lk, T/R, and AFC.

Clear RX	Clear TX	<CALL> Resend Msg	<CALL> Go Ahead	Int CNTR = 5	Net Starts in 5 mins	NCS Sartup	Net Shutdown	T/R	Tx ▶	Rx	Tune 10 Secs
CI with Traffic	CI w/o Traffic	Relay Checkin	Send Ur Msg	Nashua Mer CI	Man Goff Bed CI	Hol Brk Am Mil CI	All Others CI	ANCS CALL on Freq?	Alternate NCS?	Good Copy	Tune 60 Secs
	Returning to Voice	CALL Rdy to Cpy?	Thank You	Nothing Heard ...	QTH CI		Any Relays?	MT63-2KL	MFSK32	Save Macros	Check List
TX MYCALL	TX MY Call / QTH	Ready to Copy!	You're Welcome	NCS ACK CALL	Any Business?	<CALL> Standby	<CALL> Send Msg	NCS ID	NCS TX	Stby FLAMP	Left Click - execute Right Click - edit

Remote Computer Operation

VHF GoBox

Winlink Express 1.7.2.0 - K1EHZ

K1EHZ Settings Message Attachments Move To: Deleted Items Delete Open Session: Vara FM Winlink Logs Help

In Vara FM Winlink session.

System Folders	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
Inbox (0 unread)	2022/11/02 23:45	N069GNXASCRS	455	N1KWG	N1KWG	K1EHZ (P2P)	QTC 1 R MANCHESTER NH 03104
Read Items (0)	2022/11/05 13:54	S76RHLO4IAT5	511	N1KWG	N1KWG	K1EHZ (P2P)	Re: Leaving Net
Outbox (0)							

Vara FM Winlink Session - K1EHZ

Exit Settings Switch to Peer-to-Peer

Connection: Direct K1EHZ-12

Favorites: K1EHZ-10 @ 145.710

In: 705/1639 Out: 0/0 BPM: 7492 Connected

*** Connected to Winlink RMS: K1EHZ-12 @ 2022-11-05 13:54:00
 Welcome to K1EHZ-12 Winlink Gateway hosted by [WL2K-5.0-B2FWIHJM\$]
 :PQ: 31184258
 CMS via K1EHZ >
 :FW: K1EHZ
 [RMS Express-1.7.2.0-B2FHMs]
 :PR: 12150340
 : K1EHZ-12 DE K1EHZ (FN42EX)
 FF
 :PM: K1EHZ JM72H1T5JVKZ 1639 KB1TCE@winlink.org
 :PM: K1EHZ U131DRY5PDIZ 1771 KB1TCE@winlink.org
 :PM: K1EHZ HCB23PTHQB9G 2833 KB1TCE@winlink.org
 Commemoration)
 FC EM JM72H1T5JVKZ 3103 1639 0
 FC EM U131DRY5PDIZ 3374 1771 0
 FC EM HCB23PTHQB9G 5407 2833 0
 F> 80
 FS YYY
 *** Receiving JM72H1T5JVKZ

VARA FM v4.2.3 K1EHZ

Settings View Ping Log* Help

bps

DATA

ACK IDLE

NACK BREAK

REQ QRT

VU CPU TX Delay S/N

%CPU not available

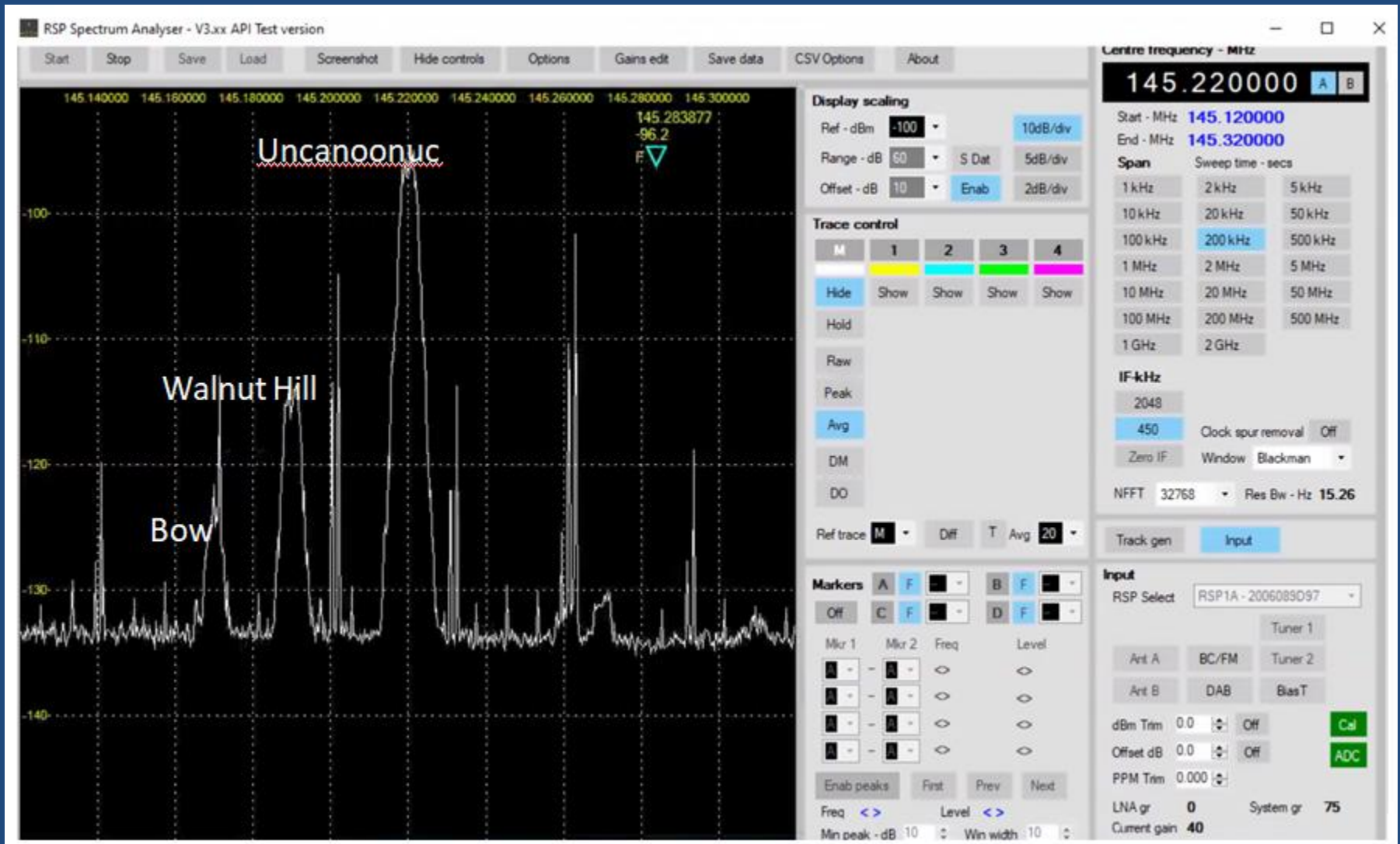
TX Delay 85 ms

S/N (2500 Hz) +8.4 dB

RX K1EHZ <-> K1EHZ-12 (2) 1188 bps

Remote Computer Operation

RF Spectrum Analyzer on SDRplay / Beelink T4



CROTCHED - SOUTH UNCANOONUC 5GHZ MESH - DMR LINK

Joint Project

**Merrimack Valley Amateur Radio Association &
New England Digital Emergency Communications Network**



Photo by Paul Blais KC1KMM

Bill Barber NE1B

Paul Blais KC1KMM

Marc Bourque NI1E

Sean Fichera KB1OTI

Remy Fortin KB1SGK

Ted Gamlin K1OX

Jen Herting KD2BEC

Joel Huntley WA1ZYX

Brian King KX1B

Brian McCaffrey W1BP

Mike Miller W1EAA

Wally O'Donnell N1GLT

Dave Pascoe KM3T

Jay Taft K1EHZ

Project Team

Project Objectives

- Replace discontinued internet access at Crotched Mt with an AREDN 5GHz link to South Uncanoonuc
 - Pre-existing Ubiquiti 5GHz DMR link from Uncanoonuc to Bow, NH
- Evaluate stability of the 14-mile AREDN 5GHz link
- Evaluate how well the AREDN system passes DMR traffic from Crotched Mt to the broader DMR network
- Evaluate how well the system can be managed remotely
- Establish a process for future installations and collaboration

Bumpy ride to
Crotched summit
in the
NI1E mobile



Photo by Marc Bourque NI1E

Joel WA1ZYX and
Paul KC1KMM
installing AREDN
5GHz router



Photo by Jay Taft K1EHZ

Router
installation
completed



Photo by Jay Taft K1EHZ

NEDECN Site
South Uncanoonuc
Looking West



Photo by Brian McCaffrey W1BP



NEDECN Site
South Uncanoonuc
Looking South

Photo by Brian McCaffrey W1BP

Remy KB1SGK
Installing new
AREDN routers



Photo by Jay Taft K1EHZ

How well does the link work?

K1EHZ-Crotched1-NH-UNC

Location: 42.998320 -71.873830 **Actual SNR close to Model**

Ubiquiti PBE-M5-300 from K9AEN. Located on Crotched Mt and aimed towards Mt Uncanoonuc.

[Help](#)


Refresh

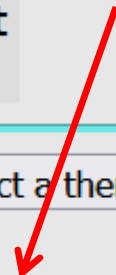
Mesh Status

Neighbor Status

WiFi Scan

Setup

Select a theme 



Wifi address 10.208.238.212 / 8
LAN address 10.135.118.161 / 29
WAN address none
default gateway 10.180.210.36
K1EHZ-Uncanoonuc1-NH-CRT
SSID AREDN-5-v3
Channel 149
Bandwidth 5 MHz

Signal/Noise/Ratio **-75 / -95 / 20 dB** [Charts](#)
firmware version 3.22.8.0
model Ubiquiti PowerBeam M5 XW 300
system time Tue Oct 25 2022 13:59:36 UTC
uptime 3 days, 19:42
load average 0.21, 0.05, 0.01
free space flash = 2308 KB
/tmp = 29896 KB
memory = 32300 KB
OLSR Entries Total = 119
Nodes = 31


IperfSpeed Performance of AREDN Link

DMR needs 0.16 Mbits/sec

Previous Tests

Time	Server	Client	Result	
11/3/22 1:34 PM	K1EHZ-Crotched1-NH-UNC	K1EHZ-Uncanoonuc1-NH-CRT	4.13 Mbits/sec	RE-TEST
10/26/22 8:49 AM	K1EHZ-Crotched1-NH-UNC	K1EHZ-Uncanoonuc1-NH-CRT	4.38 Mbits/sec	RE-TEST
10/26/22 8:48 AM	K1EHZ-Crotched1-NH-UNC	K1EHZ-Uncanoonuc1-NH-CRT	4.21 Mbits/sec	RE-TEST
10/25/22 8:35 AM	K1EHZ-Crotched1-NH-UNC	K1EHZ-Uncanoonuc1-NH-CRT	4.01 Mbits/sec	RE-TEST
10/25/22 8:34 AM	K1EHZ-Crotched1-NH-UNC	K1EHZ-Uncanoonuc1-NH-CRT	3.61 Mbits/sec	RE-TEST

DMR Repeater Performance

		Control Center NewEng-TRBO	
K1QVC-Derry	13133027		
K2ATY-Mt. Beacon-U	13133028	K2ATY - Mt. Beacon NY USA -- 113619	
K1RE-Gunstock-V	13133029	K1RE - Gunstock Mtn NH USA -- 313303	Issue
K1OX-Bow	13133030	K1OX - Bow NH USA -- 313304	KB1CFL - Concord NH USA -- 313325
K1OX-Chester	13133031	K1OX - Chester NH USA -- 313305	
KC1KAM-Campton	13133032	KC1KAM - Campton NH USA -- 313306	Offline
KM3T-Goffstown-V	13133033	KM3T - Goffstown NH USA -- 313307	
WIWNS-Somersworth	13133035		
K1MOT-Hudson-V	13133036	K1MOT - Hudson NH USA -- 313302	
KM3T-Goffstown-U	13133037	KM3T - Goffstown NH USA -- 313316	
AE1C-Southboro-U	13133038	AE1C - Southboro MA USA -- 312519	
K1RE-Gilford-U	13133039	K1RE - Gilford NH USA -- 313320	
W1BOS-Boston-U	13133040	W1BOS - Boston MA USA -- 312522	Normal
NE1B-Portable	13133041	NE1B - Hudson NH USA -- 313308	
WA1ZYX-Crotched Mt.	13133042	WA1ZYX - Crotched Mtn NH USA -- 310178	
K1IR-Sudbury	13133043	K1IR - Sudbury MA USA -- 310956	

LIVE WEB LINKS WHEN ON MESH

[Crotched Mt Router](#)

[Uncanoonuc Router](#)

[DMR C-Bridge](#)

[Mesh Network Map - Jen KD2BEC](#)

[Mesh Network Diagram – Jen KD2BEC](#)

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- ★ Evaluate how well the system can be managed remotely
- ★ Establish a process for future installations and collaboration



The End

Photo by Jay Taft K1EHZ

