

# Broadband-Hamnet formerly HSMM-Mesh



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## Broadband Hamnet – What is it?

Broadband-Hamnet™ is a high speed, self discovering, fault tolerant, self configuring **ham network**/wireless computer network that can run for days from a fully charged car battery, or indefinitely with the addition of a modest solar array or other supplemental power source. Its primary focus is on emergency communications.

Broadband-Hamnet™ is currently being designed, developed and deployed as an amateur radio broadband communications system. It originated in Austin, Texas but has spread all across the USA and many other countries around the world.

In its current form it is built using the Linksys WRT54G/GL/GS wireless routers and operates on channels 1-6 of the 2.4GHz ISM band, which overlaps with the upper portion of the 13cm amateur radio band.

It is time to have our own broadband network. Hams have transferred IP data by radio for ages. This network is FAST! 802.11g wireless routers can do 54 Mb/s compared to 802.11b at 10 Mb/s and Packet at 1.2 or 9.6 Kb/s.

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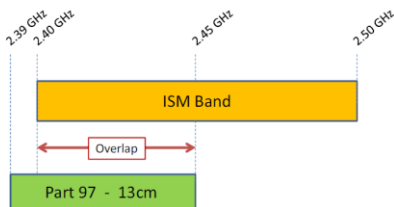
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## 802.11g Wireless Band



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## 802.11g Wireless Band

Channel	Low Freq	Center Freq	High Freq
1	2.401 GHz	2.412 GHz	2.423 GHz
2	2.406 GHz	2.417 GHz	2.428 GHz
3	2.411 GHz	2.422 GHz	2.433 GHz
4	2.416 GHz	2.427 GHz	2.438 GHz
5	2.421 GHz	2.432 GHz	2.443 GHz
6	2.426 GHz	2.437 GHz	2.448 GHz
7	2.431 GHz	2.442 GHz	2.453 GHz
8	2.436 GHz	2.447 GHz	2.458 GHz
9	2.441 GHz	2.452 GHz	2.463 GHz
10	2.446 GHz	2.457 GHz	2.468 GHz
11	2.451GHz	2.462 GHz	2.473 GHz

### Some Basic Concepts

**Broadband-Hamnet is a network, it is not application software.** It is a special firmware build that transforms consumer wireless gear to a specialized ham radio function. It can use application software to transport your data from place to place, but you must provide the application software just like you do at your home or office.

**A Mesh network is a highway over which data travels.** Turning on two mesh nodes loaded with the Broadband-Hamnet firmware creates a data network. This highway carries your cargo (data), and allows your local computer to use information or applications stored in other locations.

Mesh nodes are originally consumer wireless routers but by updating the internal software the function of the device can be changed. They are a data network without the wires. Most tasks that you can do over a wired or wireless network at your home or office will work on a mesh node

Mesh nodes are small, portable, low-power and inexpensive. They are easily battery powered and can have a range of **10 miles or more using stock power** and gain antennas if you have true line of sight.

Mesh nodes only connect to other mesh nodes using peer to peer connections. This means each node can connect to all others it can directly reach.

Mesh nodes operate on channel 1. Channels 1-6 of the 802.11B/G wireless band are completely within the 2.4GHz ham band.

Mesh nodes on channels 1-6 use FCC part 97 rules instead of part 15. This allows big antennas, more power, other changes.

Mesh nodes talk to other nodes using RF (Wi-Fi), to the Internet over the WAN port and to computers, servers, video cameras and other devices using the LAN ports.

Mesh nodes will create a network just by turning several of them on. They create portable, high-speed data networks in minutes.

Mesh nodes don't need any computer to be attached to pass data to other mesh nodes. Just plug one in, it will expand the mesh.

You don't need to physically attach to a given mesh node to make changes to it. You may "remote in" to configure it from anywhere on the mesh network

Data is data. It can be IP Video, VOIP, LAN traffic between computers, a web browser reading a situation briefing web page, downloading operating software or a radio manual by FTP, printing out something on a remote printer, keyboard chat, hop to the Internet, etc.

IP addresses exist but you interact with mesh nodes by using the node name. The names can be tactical but your ham call is still sent out frequently as a beacon packet.

Any mesh node within wireless range automatically joins the existing mesh and exchanges available routes with all others. If one mesh node has Internet access or contains a NTP (network time protocol) server, all mesh nodes will get a correct date/time in their display

As signals grow stronger and fade, nodes join and leave the mesh. It can happen many times as you drive around. Your path between any two mesh nodes may be single or multiple hop and can/will change with no notice or impact to you. The data flows where it needs to flow because of the automatic routing delivered by OLSR.

A single node joining your mesh may add many other nodes if it can see other mesh nodes the first group can't reach. It does so by becoming a bridge to join the two separate groups of mesh nodes.

Mesh node owners from different parts of the country will join any existing mesh just by coming within range if it.

**Several mesh nodes + one experienced ham operator = a portable, quick deployment, swiss army knife of network services**

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## How does it work?

As long as one node can see another, devices on the network can talk to other devices on the network and each node can relay traffic between nodes. Between any 2 computers or devices, you can have multiple paths, giving redundancy in case one node goes down. Paths of different quality are automatically considered. If one path is worse than another, it gets less traffic.

If a node that is in use goes down, the surrounding nodes will automatically figure out an alternate route to pass traffic. Using OLSR (Optimized Link State Routing Protocol) the best route is automatically determined and used.

Items connected to nodes can be any network-enabled device, such as Computers, IP webcams, IP telephones, web, email, or file servers, RMS winlink nodes, network-attached-storage and other devices. Anything that can communicate over a standard TCP/IP network will work over Broadband-Hamnet™.

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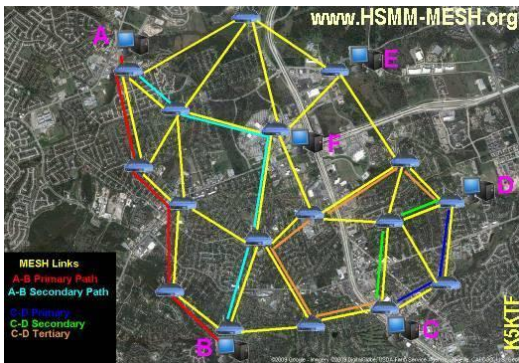
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## Hardware Required



### Option #1

A Cisco Systems Linksys WRT54G series consumer grade WiFi Router loaded with Broadband-Hamnet firmware (loading instructions can be found on the web at: <http://www.broadband-hamnet.org/>)

It CANNOT be a version 5.0 or higher, all other versions are supported.  
NOTE: WRT54G v 1.0 uses regulated 5v, all other devices use 12v.

For specific details please refer to this document:

[http://www.broadband-hamnet.org/images/hsmm\\_docs/WRT54Shop.pdf](http://www.broadband-hamnet.org/images/hsmm_docs/WRT54Shop.pdf)

### Option #2

A Raspberry Pi computer running either HSMM-Pi or HSMM-Mesh software and any USB WiFi dongle

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## Antenna Options



Circular, Rectangular or Flat Panel = 8-24Dbi

12 EI beam = 20Dbi  
16 EI beam = 24DBi

Verticals  
8 Dbi  
12 Dbi  
15 Dbi

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## Modifying the Linksys Router

1. Get the latest Broadband-Hamnet Firmware from:  
<http://www.broadband-hamnet.org/download/firmware/index.html>
2. Using one of the 4 Ethernet ports update the original router firmware with the appropriate binary (.bin) file using a standard internet browser and the routers internal menu
3. Log into your new Broadband-Hamnet node
4. Give it a node name (i.e. KA&OAD-1)
5. Change the password
6. Save and reboot
7. Get it within range of another
8. CONNECTED!!

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Broadband-Hamnet on a van



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A typical portable omni-directional node



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A typical portable uni-directional node



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### Broadband-Hamnet in a box



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### Broadband-Hamnet in a backpack



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### Broadband-Hamnet is Low Power

Using Broadband-Hamnet, a Linksys WRT54G has a maximum power output of 79mW. That's 0.079W! It uses a standard 12V input (accepts from 4V to 16V).

Operating time on one time use alkaline batteries:

- 00:22 – 1x 9V
- 01:36 – 4x AA
- 05:15 – 8x AA
- 05:20 – 4x D
- 08:30 – 6x C
- 09:55 – 1x 6V Lantern

Operating time using rechargeable sealed lead acid:

- 2:30 – 1.3 Ah
- 32:00 – 7.5 Ah

A 55 Ah SLA battery with a 45W solar panel under suboptimal conditions can run a WRT54G indefinitely

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Information from the following sources:

<http://www.broadband-hamnet.org/>

With special thanks to:

W8MRC: <http://w8mrc.com/docs/presentations/HSMM-MESH-Web.pdf>

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