



HOST OF THE 2014
WEST GULF & DELTA
DIVISIONS CELEBRATION



Broadband-Hamnet™



Kipton Moravec AE5IB

HAM-COM

June 14, 2014

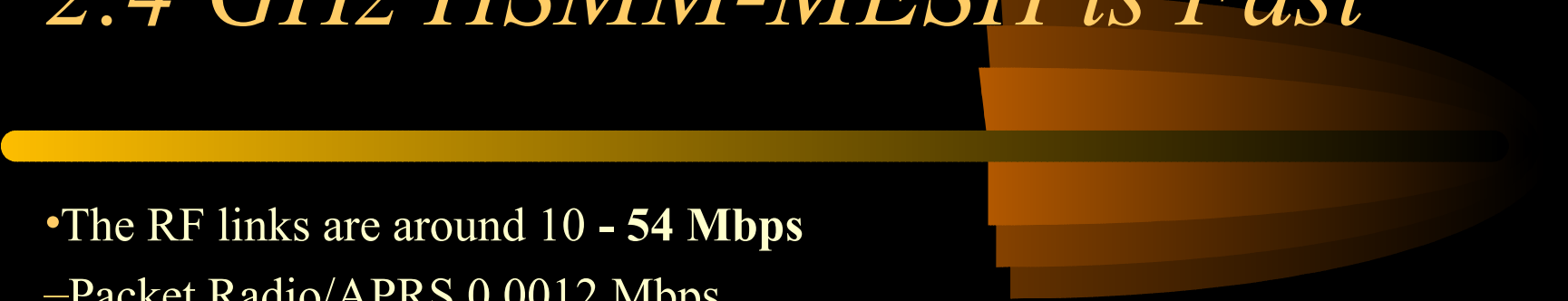
Plano, Texas

Broadband-Hamnet



- New name for HSMM-MESH
- Hopefully easier for people to understand what it is.
 - Most people relate Broadband to high speed data networks
 - Hamnet is a network for Amateur Radio Operators.
 - It is a registered trademark so we can insure Broadband-Hamnet devices can talk to one another.

2.4 GHz HSMM-MESH is Fast



- The RF links are around 10 - **54 Mbps**
 - Packet Radio/APRS 0.0012 Mbps
 - Pactor III .003 Mbps
 - D-Star DD 0.128 Mbps
- Home Service
 - FiOS (Fiberoptics) 2 -10Mbps up / 15-70 Mbps down
 - T1 1.5 Mbps
 - DSL usually 1.5 Mbps up / 6 Mbps down
- ATT highest DSL is now 300 Mbps
- often 0.768 Mbps, 0.512 Mbps, 0.368 Mbps
 - Dialup 0.014 – 0.056 Mbps

Strategy and Planning



- Know what the system can do and its limits
 - Channels 1, 6, and 11 are non-overlapping
 - Channel 1 through 6 are in Ham band,
 - Channels 7 through 11 are not
- Need Clear Line of Sight
- Trees attenuate a lot
- Hills, buildings block
- Big Crowds of people are a problem
 - Cell Phones with WiFi – seems to be better

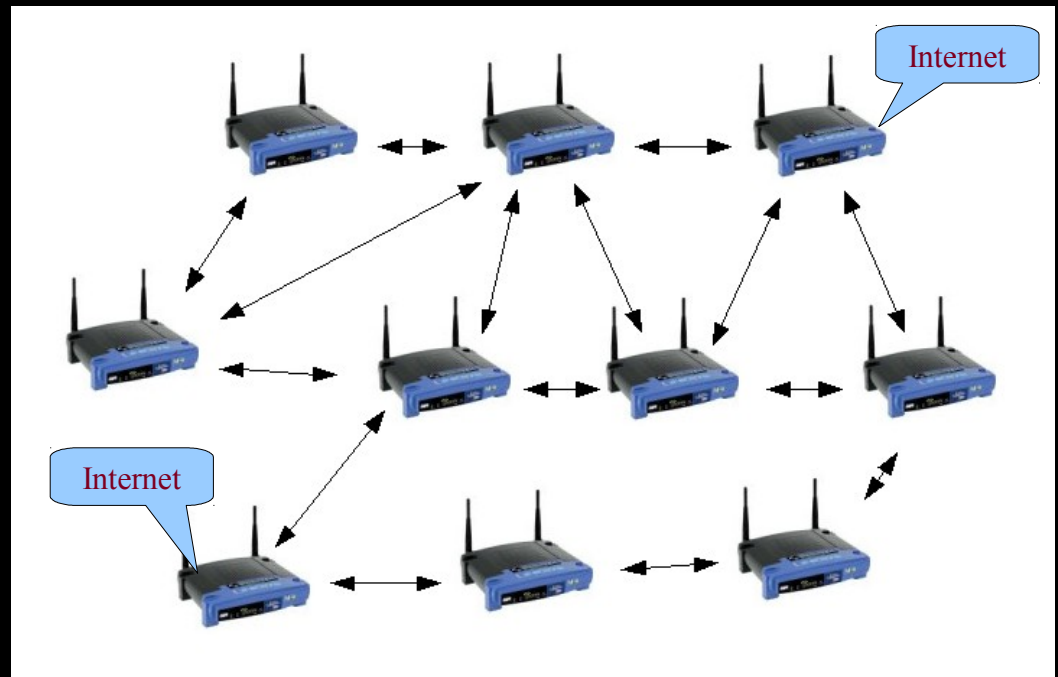
Security



- Interpretation to ARRL HSMM WG from FCC Enforcement Branch via Chris Imlay
- Radio Amateurs using 802.11 type modulation under Part 97 could use WEP, WPA, etc as our intent or purpose is to provide authentication and thus protect our networks from part 15 intrusions... and not obscure the meaning of the signals.
- Under the following 4 conditions:
 1. Use only frequencies above 50 MHz
 2. No foreign/international traffic is permitted
 3. The type of encryption used must be standardized and published
 4. The specific encryption key used must be recorded in the station logbook
- More detail in ARRL VHF Digital Handbook, Chapter 7, HSMM Radio

MESH automatically finds Routes

- Finds shortest route
- Fixes broken routes
- Adds routers as they show up
- No manual configuration



What's needed for HSMM-MESH



- Custom SW - HSMM-MESH
- Off the shelf WiFi Routers
 - \$50 - \$100 (less than any new Ham radio)
 - Must support external antennas
 - Operate channels 1 – 6 Ham Bands
- High Gain Antennas
 - \$20 - \$100 (or More) Omni or Directional
- Accessories
 - Power, batteries, cables, masts, boxes, etc.

HSMM-MESH Node Status

AE5IB-N11

[Help](#)[Refresh](#)[Mesh Status](#)[OLSR Status](#)[WiFi Scan](#)[Setup](#)☐ Night Mode

WiFi address	10.45.60.136 / 8 fe80::4af8:b3ff:fe2d:3c88 Link	Signal/Noise/Ratio	-67 / -88 / 21 dB	Auto
LAN address	10.105.228.65 / 29 fe80::4af8:b3ff:fe2d:3c86 Link	firmware version	1.0.0	
WAN address	192.168.2.101 / 24 fe80::4af8:b3ff:fe2d:3c86 Link	configuration	mesh	
default gateway	192.168.2.1	system time	Thu Jan 16 2014 02:26:42 UTC	
your address	10.105.228.66	uptime	5 days, 17 min	
		load average	0.00, 0.00, 0.00	
			flash = 688 KB	
		free space	/tmp = 7056 KB	
			memory = 2088 KB	

MESH Status Tab

AE5IB-N11 mesh status

Stop

Quit

Local Hosts

Services

AE5IB-N11

• TL-SC2020

[Camera](#)

Remote Nodes

ETX

Services

none

Current Neighbors

LQ

Services

[AE5IB-N10](#)

89%

[AE5IB-N13](#)

100%

[AE5IB-N7](#)

89%

Previous Neighbors

When

none

HSMM-MESH Setup Page

[Node Status](#)**Basic Setup**[Port Forwarding,
DHCP, and Services](#)[Administration](#)[Help](#)

Save Changes

Reset Values

Default Values

Reboot

Node Name AE5IB-N11

Password

Node Type Mesh Node

Verify Password

WiFi

Protocol Static
IP Address 10.45.60.136
Netmask 255.0.0.0
SSID BroadbandHamne
Mode Ad-Hoc
Channel 1

Active Settings

Rx Antenna Diversity
Tx Antenna Diversity
Tx Power 19 dBm
Distance 0
Apply

LAN

LAN Mode 5 host Direct
IP Address 10.105.228.65
Netmask 255.255.255.248
DHCP Server ☒
DHCP Start 66
DHCP End 70

WAN

Protocol DHCP
DNS 1 8.8.8.8
DNS 2 8.8.4.4
Mesh Gateway ☐

Enter Name

Basic Setup

[Port Forwarding](#)
[DHCP, and Services](#)

[Administration](#)

[Help](#)

Save Changes

Reset Values

Default Values

Reboot

Automatic
from MAC

Node Name AE5IB-N11

Password

Change
Password
from default:
hsmm

Node Type Mesh Node

Verify Password

Must not
change

You can
set

WiFi

Protocol Static

IP Address 10.45.60.136

Netmask 255.0.0.0

SSID BroadbandHamne

Mode Ad-Hoc

Channel 1

Active Settings

Rx Antenna Diversity

Tx Antenna Diversity

Tx Power 19 dBm

Distance 0

Apply

LAN

LAN Mode 5 host Direct

IP Address 10.105.228.65

Netmask 255.255.255.248

DHCP Server ☒

DHCP Start 66

DHCP End 70

0 Automatic
otherwise
meters

WAN

Protocol DHCP

DNS 1 8.8.8.8

DNS 2 8.8.4.4

Mesh Gateway ☐

This node Conn

Save Changes
and Reboot

Port Forwarding, DHCP, and Services

[Node Status](#)[Basic Setup](#)[Port Forwarding, DHCP, and Services](#)[Administration](#)

[Help](#)

DHCP Address Reservations

Hostname	IP Address	MAC Address	
TL-SC2020	10.105.228.69	f8:d1:11:7c:84:6d	Del
	- IP Address -		Add

Advertised Services

Name	Link	URL	
Camera	☒ http	:// TL-SC2020 :80 /	Del
	☐	:// AE5IB-N11 : /	Add

Current DHCP Leases

Acer-Laptop	10.105.228.66	88:ae:1d:79:61:2f	Add
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Port Forwarding

Interface	Type	Outside Port	LAN IP	LAN Port	
WAN	TCP		- IP Address -		Add

Administration

[Node Status](#)[Basic Setup](#)[Port Forwarding,
DHCP, and Services](#)[Administration](#)[Help](#)

Firmware Update

current version: 1.0.0

Upload Firmware

No file chosen

Download Firmware

Package Management

Upload Package

No file chosen

Download Package

Remove Package

Authorized SSH Keys

Upload Key

No file chosen

Remove Key

Download Firmware

[Node Status](#)[Basic Setup](#)[Port Forwarding,
DHCP, and Services](#)[Administration](#)[Help](#)

Firmware Update

Downloading firmware list...
Done.

current version: 1.0.0

Upload Firmware

No file chosen

Download Firmware

bbhn-1.0.0-brcm.trx

- Select Firmware -
bbhn-1.0.0-brcm.trx
hsmm-mesh-0.4.3-brcm.trx
Linksys-WRT54G.trx
Linksys-WRT54GL.trx

Upload Package

No file chosen

Download Package

- Select Package -

Remove Package

- Select Package -

Authorized SSH Keys

Upload Key

No file chosen

Remove Key

- Select Key -

Traditional HSMM-MESH Routers



- WRT54G (v1-4)
- WRT54GL (all)
- USR5461
- WA840G
- WE800G
- WR850G (v1-3)
- WRT150N
- WRT300N (v1)
- WRT54G3G
- WRT54GS (v1-3)
- WRT54GS (v4)
- WRTSL54GS (all)

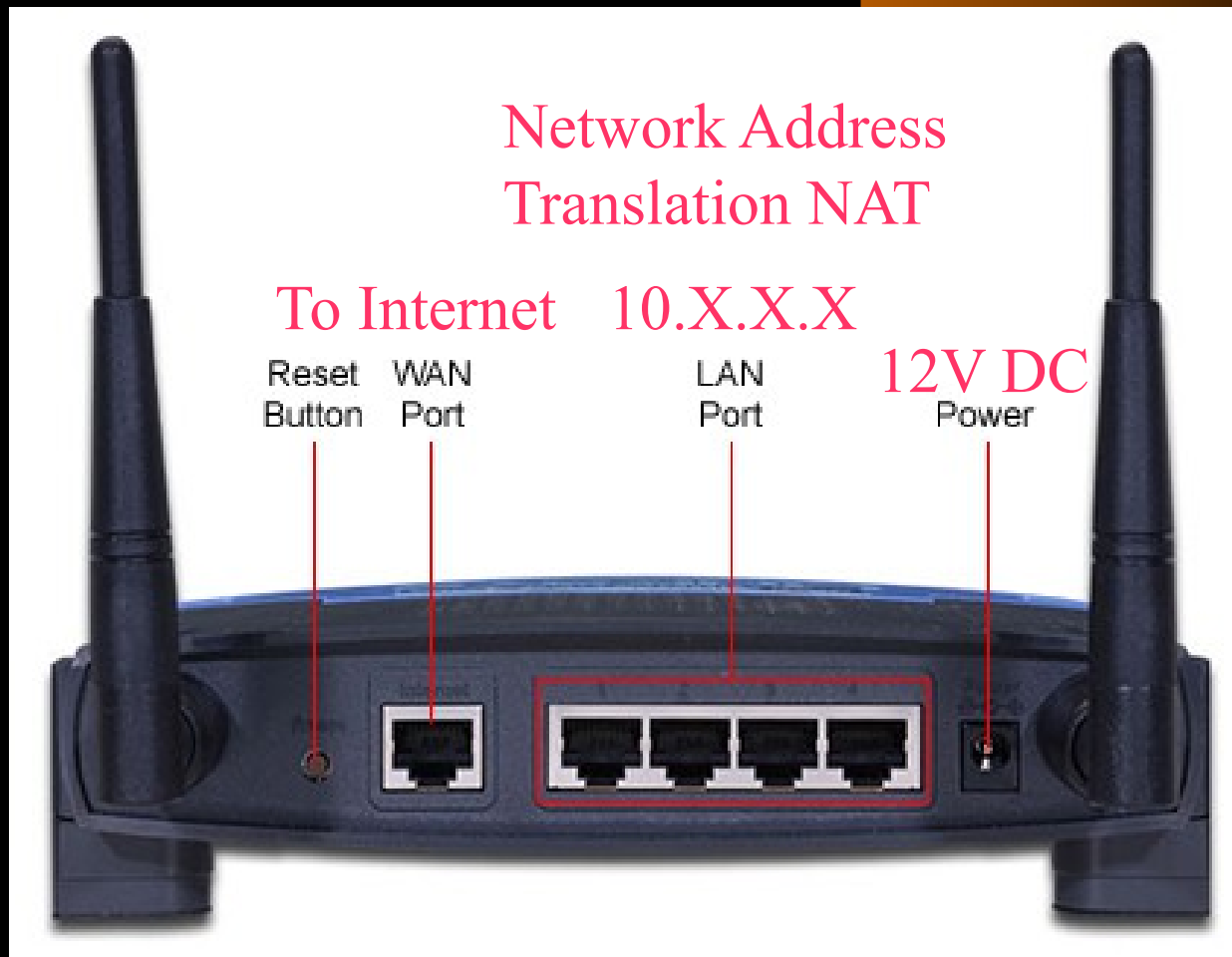
Stay with WRT54GL to be safest

Router I Like

- Linksys WRT54G used
 - Versions lower than v.4
 - 4 Mb Flash
 - Current new is v.8
 - 2 Mb Flash
 - Soldered Antennas
- Linksys WRT54GL new
 - Linksys v.4
 - 4 Mb Flash
 - \$54.00 - \$79.99 New
- Built in regulator for 12VDC (7.5V to 18V DC)
- Two Serial Ports!



After Default HSMM-MESH Setup



Ubiquiti Devices

- Bullet M2 HP
- Rocket M2
- AirGrid M2 HP
- NanoStation Loco M2 (NSL-M2)
- NanoStation M2 (NS-M2)



Antennas



- All kinds available on internet
 - The ones in retail stores are very expensive!
- Vertical polarity
 - Omni-directional best for HSMM-MESH
 - Laptop Computers
- Horizontal polarity for point-to-point networking.
 - Less interference from other users

Range



- Range is based on
 - Antenna
 - Noise
- Assume
 - Clear Line of Sight
 - Good Day
 - 19 db Transmitter
- Two 12 db - 5 mi
- Two 15 db - 10 mi
- Two 19 db - 24 mi

Bigger is Better

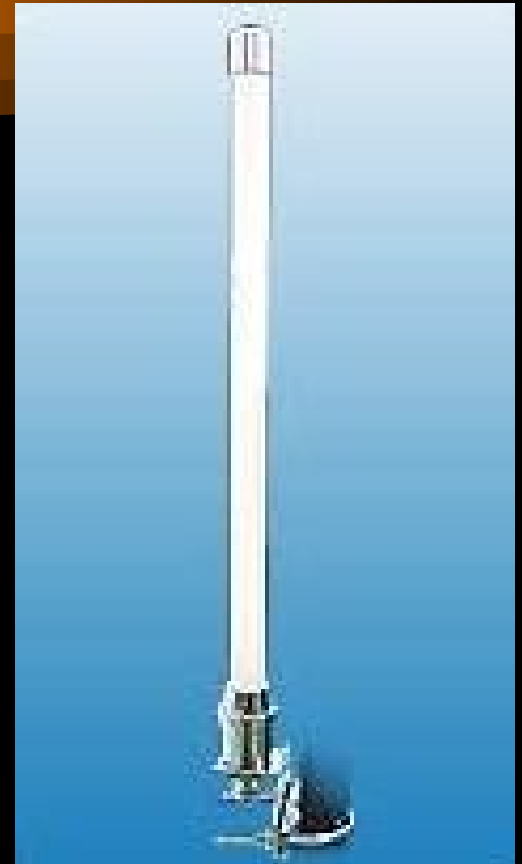
15 db Omni

- Titan Wireless AT-15OM-24
- Lowest price 12 db Omni \$55
- N connector
- Not Bad
 - High Gain
 - Low Cost
 - Fast Delivery



8 db Omni

- Titan Wireless AT-8OM-24
- 8 db omni \$35
- About 1 foot tall
- Good for special events and short distances



RooTenna

- RooTennas

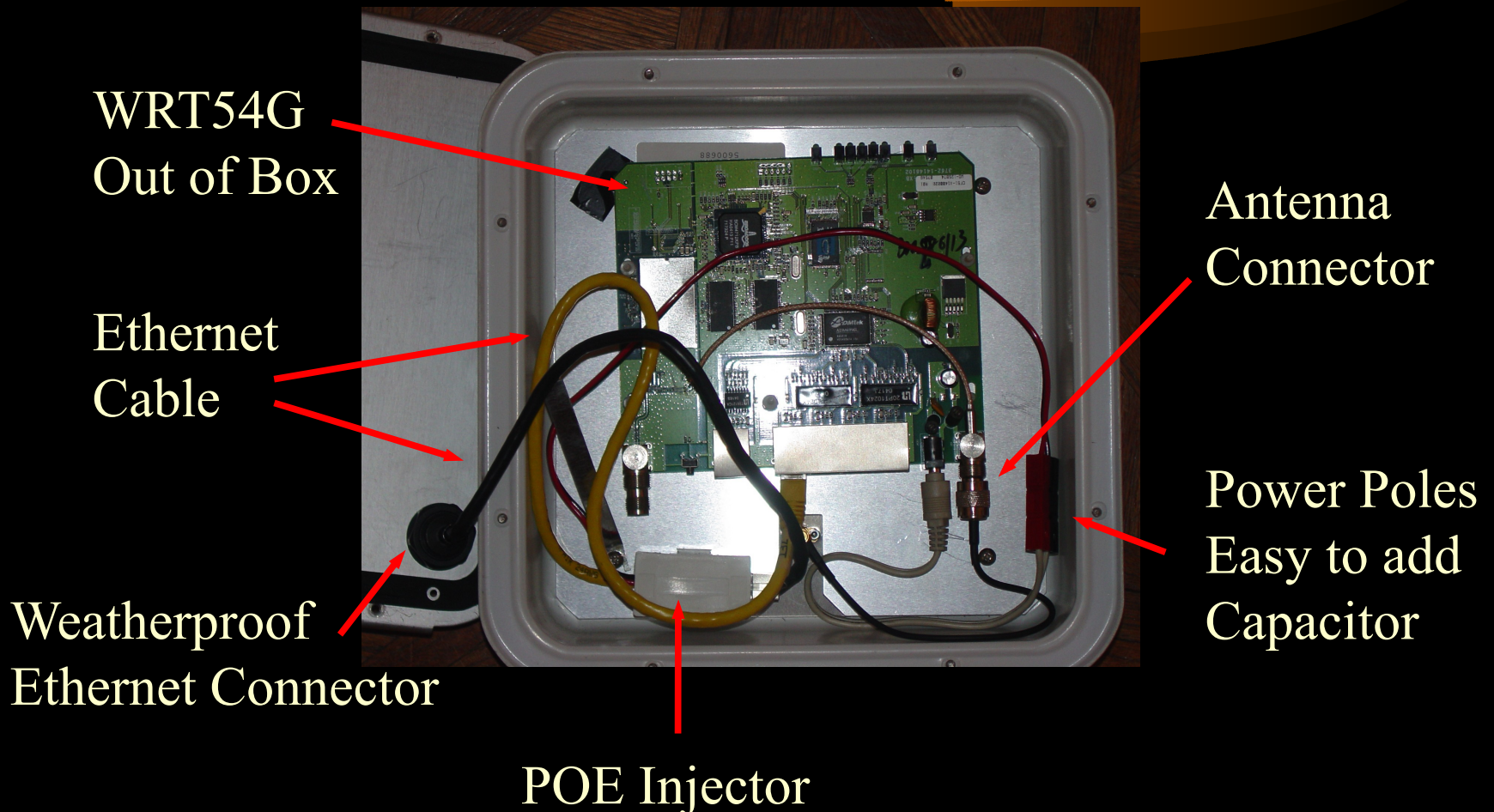
- Mounts on mast, easy switch from vertical to horizontal
- Built-in housing for router
- 19 db with housing
 - \$68.00 - \$74.00
- 15 db with housing
 - \$40.00 - \$45.00

Titan Wireless

<http://www.titanwirelessonline.com/>



Inside 15 db Rootenna



Antennas We Like

- HyperLink Die Cast Reflector Grid

- Models

- 30 db 5.3° beam \$479.99

- 24 db 8° beam \$69.99

- 19 db 12° beam \$59.99

- 15 db 16° beam \$49.99

- 24 db is recommended

- Otherwise Rootenna is cheaper

L-Com Technologies

<http://www.l-com.com>



KD5MFW 2 Ant.

- 12 db omni
- 24 db directional Horz. Pol



AD500 Portable Node

- 12 db Omni Antenna
- Weatherproof Box for Router
- Tripod
- Mast



Companies to know about

- fab-corp.com
- l-com.com
- wlanparts.com
- titanwirelessonline.com



Passive Power Over Ethernet

- I like 12V Passive P.O.E.
 - Simple adapters
 - Home made or purchased
 - Use Power Poles for 12V power
 - Compatible with rest of Ham Equipment
- Pins 4 & 5 +12V / Pins 7 & 8 0V or Gnd
- Simplifies wiring - 1 Ethernet wire



12V POE Solution



- Problems with voltage fluctuation on POE Ethernet runs 200 feet and over
- To smooth out the current demand need a big capacitor.
- 10,000 MFD Works 1000 MFD Does not.
- The voltage stayed steady enough that I was able to reduce the supply to 7.5 volts at the router and it still worked.
- Adding 10,000 MFD, 50V 105°C Electrolytic capacitor to all routers because you do not know how long Ethernet runs will be.

2013 Plano Balloon Festival



- Experimented with Ubiquity 3.4 GHz M2 units
- Put in parallel with Broadband-Hamnet
- Noise level 30 db lower than 2.4 GHz
- Made full speed connection with 6 mW
- Amateur Radio allocation in US
- Hard to get HW not sold in U.S.

Plano Balloon Festival Site 2013



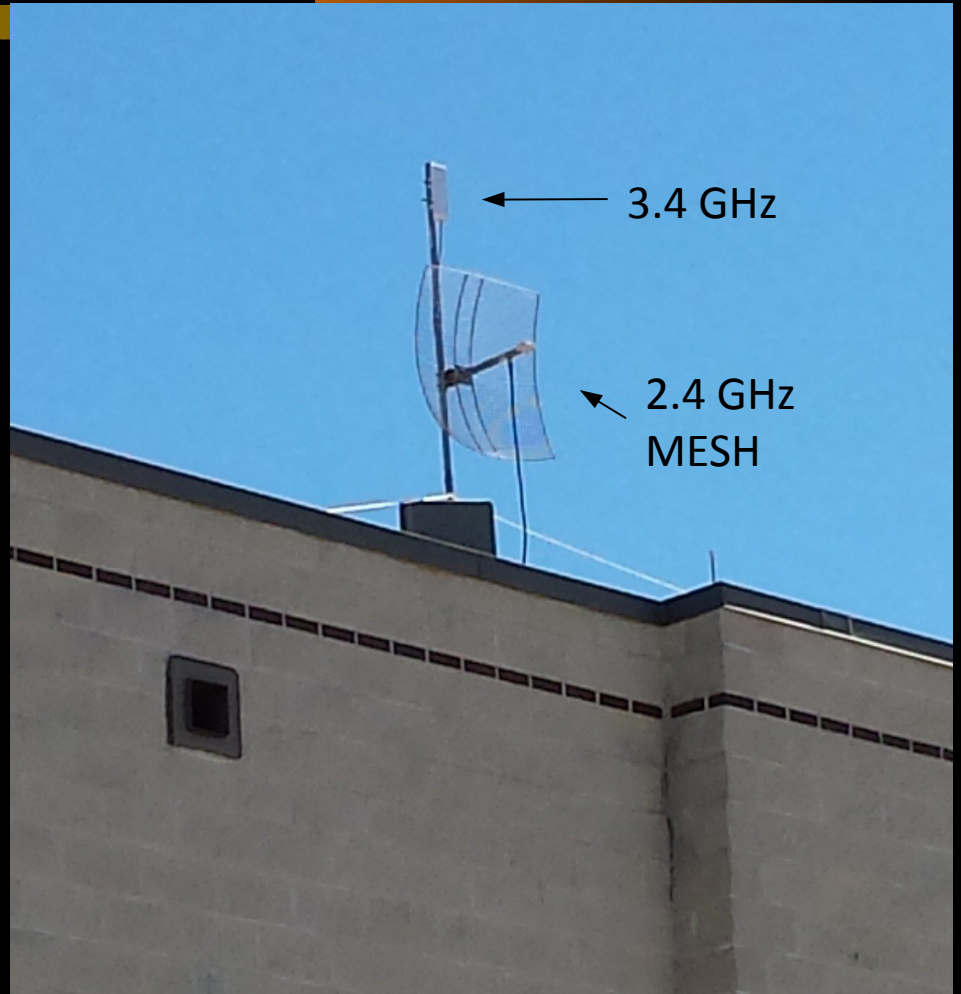
- Field Operations
- Communications Trailer
-
-
-
- Special Event Station
-
- First United Methodist Church (Internet Access)

Church Site

Ubiquity 3.4 GHz on top

WRT54G with 24 db Horizontal
polarity Broadband-Hamnet

300 foot CAT5 from Church
Internet to our units.

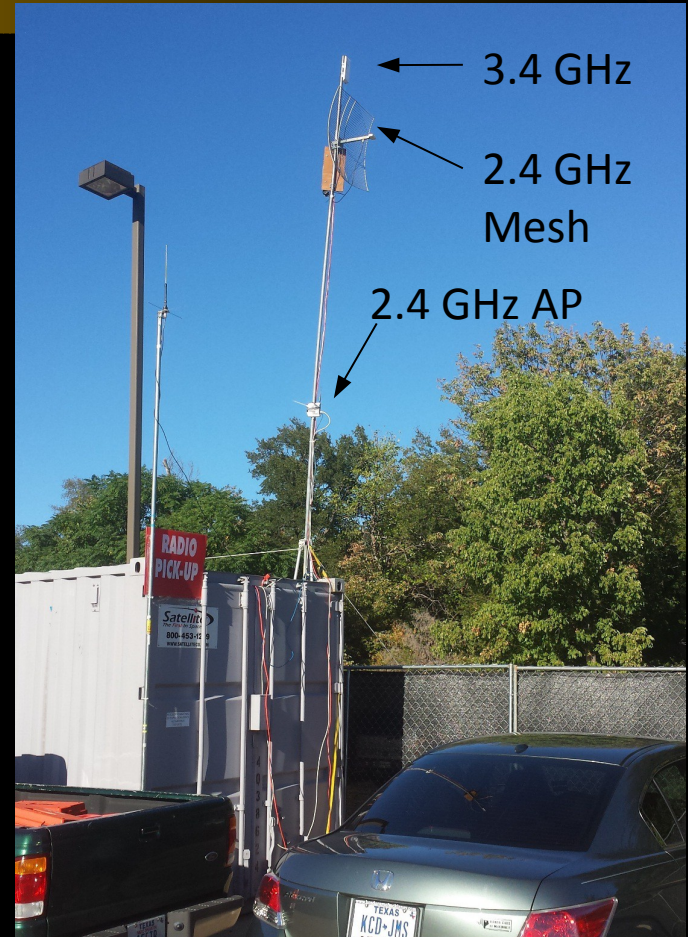


Communications Trailer

3.4 GHz Ubiquity

2.4 GHz WRT54G w/ 24db
Horizontal Polarity

Last minute change to
Operations Tent. Added a WiFi
Access Point.

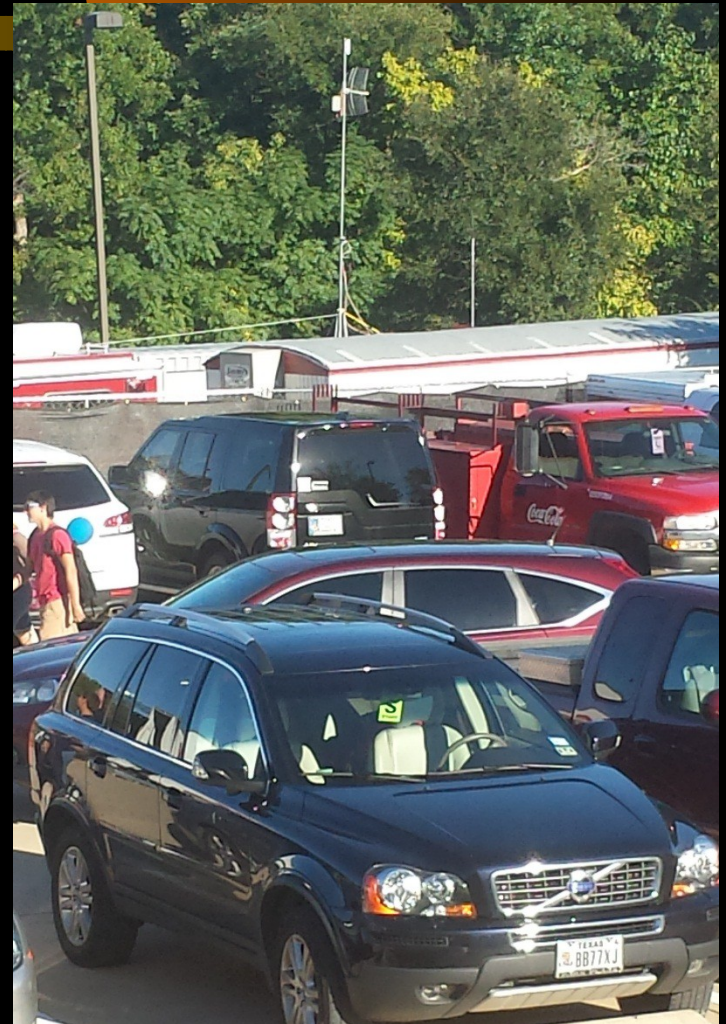


Field Operations

View from Field Operations Tent



Field Operations Tent



Special Events Station

PARK had a special event station K5B for the Plano Balloon Festival.

We gave them Internet access using Broadband-Hamnet



Wild Ride Rest Stop 2 and 3

•W5LT

•Rest Stop #3 (9.7 mi)



•Rest Stop #2 (4.5 mi)

Interesting Web Links



- Broadband-Hamnet Site

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

- Building a Rural Wireless Mesh Network

- http://wirelessafrika.meraka.org.za/wiki/index.php/DIY_Mesh_Guide

- Wireless Networking for the Developing World

- <http://wndw.net/>

- N500M HSMM Page

- <http://www.n500m.org/hsmm/>

Where to go next



- Website – www.broadband-hamnet.org
- Meetings
 - Collin County - Digital Tuesday 3rd Tuesday of the month – k5prk.net Calender
 - Austin – Digital Wednesday
- Email list
 - Dallas Area Working Group HSMM
DAWG-HSMM yahoo group
 - Austin Development Group
[Austin_HSMM_Development](mailto:Austin_HSMM_Development@yahoo.com) yahoo group