Internet Connections

2011 National HDT Rally

How much do you use the Internet?

Just for e-mail

Or….

How much do you use the Internet?

- E-mail
- Face Book
- Google Plus
- Blog reading
- Blog Writing
- E-Shopping
- Information browsing
- Trip planning
- Photo storage
- Web site browsing
- Instant Messaging
- Web site updates

How much do you use the Internet?

Probably somewhere in between,

But more than just e-mail

So the Internet is probably important to you

Enhanced Wi-Fi

Why use a Wi-Fi connection?

I have an Air-Card

I have Satellite Internet

- Why would I use Wi-Fi?

Why use a Wi-Fi connection?

I have an Air-Card
- 5 GB monthly limit

I have Satellite Internet
- response latency

Only way to get Internet

Why use a Wi-Fi connection?

- Example statistics of Wi-Fi Availability

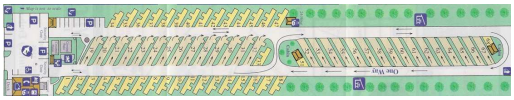
Days	Wi-Fi Available	Wi-Fi used	Wi-Fi Bad	Satellite used
186	131	108	23	78
	70%	58%	18%	42%

2010 Trip

Wi-Fi and Air-Card Problems –

- Too Far Away
- Interference
- Need for local LAN

Problems – Too far away - Wi-Fi



Sometimes the park geometry puts you far from the office, the normal location for the Wi-Fi antenna

Or:

The Cell tower is too far away

Problems – Too far away – Wi-Fi

Problems – Interference

Roof mounted antenna will clear other RVs and have a direct shot at Park Wi-Fi and Cell Towers.

Problems – Need for a local LAN




When you want multiple PC to access your wireless printer

Problems – Too far away

Problems – Interference

- Both of these problems are fixed by using an external antenna.
- Location will minimize the Interference problem.
- Antenna power will minimize the Range problem

Antennas – USB Wi-Fi Extenders

The USB wireless adapters are really integrated wireless radios and antennas. The USB cable has a length limit of 5 meters.

There are powered extension USB cables that can go long distances but they induce time delays that will probably not let the USB wireless adapter work effectively.

Effectively limited to the inside of the RV. Gain some range but still subject to other RV interference.

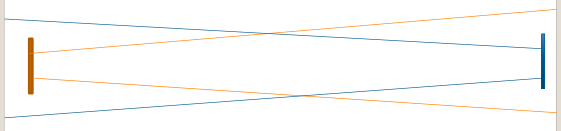
Antennas – Types

Two basic types for RV

Flat Panel
• Directional
• Most power for rating (DB)
• Have to Aim

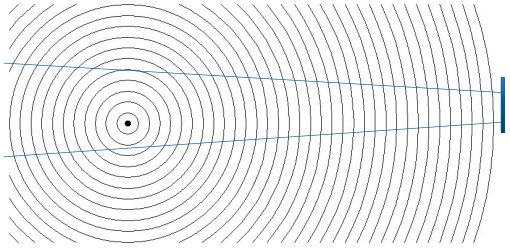
Omni-Directional
• All directions
• No aiming required
• Power not focused (DB)

Antennas – Flat Panel Directional



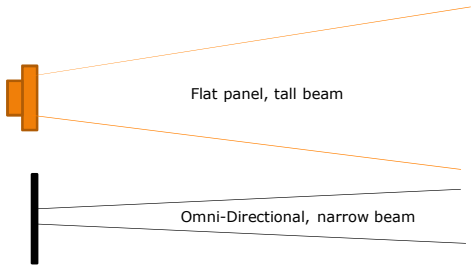
Horizontal beam in narrow pattern, power concentrated

Antennas – Omni-Directional



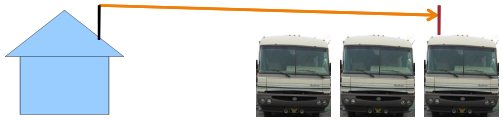
Horizontal beam in all directions, power spread out

Antennas – Vertical Beam



Generally, the higher the DB rating, the narrower the beam.

Antennas – Clear & Range



Roof mounted antenna will clear other RVs and have a direct shot at Park antennas or Cell Tower.

Antennas – Mounts – Wi-Fi

Wi-Fi antennas are generally 2.4 GHz antennas. Air-Card antennas are different frequencies.

The normal mounting method for Wi-Fi antennas and the integrated CPE radios (covered later) us U-Bolts to attach the antenna/radio to a vertical mast.

Antennas – Mounts – Wi-Fi

This antenna comes in the 8 db (db is a power rating) range. The base of the antenna has a screw mount that fits marine antenna mounts.

Marine mounts come in stainless steel and plastic. The plastic is plenty strong enough and wind loads on boats antennas is high and a lot more cost effective.

These mounts allow the antenna to be swung down for traveling.

Antennas – Mounts – Wi-Fi

I used a regular 15 db omni-antenna, U-bolted to a 4' marine antenna extension mast screwed onto a marine antenna base.

This gave a tall collapsible configuration.

I used 15 db to compensate for the omni- all around power distribution.

No need to aim, just raise. For most 8db is enough.

Antennas – Air-Card Types

For air-cards and RVs, only an omni-directional antenna makes sense.

Directional antenna
- Aiming a directional antenna to a cell tower is fitting for a fixed location like a cabin or house.

Omni-Directional
- All directions
- No aiming required
- Power not focused (DB)

Antennas – Mounts – Air-Card

Some of the external cell antennas are short enough to be mounted permanently on the roof of your RV.

Longer ones need mounts that can be taken down for travel.

Antennas – Mounts

Another option is to use a device that you can raise from inside your RV, like if you have a "Batwing" or similar TV antenna.

This can be used for Wi-Fi and Air-Card antennas.

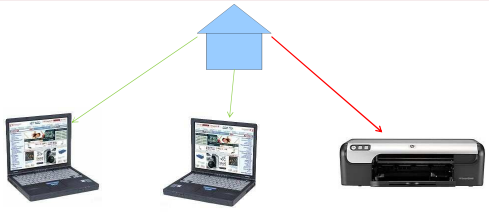
External Antennas – Issues

- To use just an antenna as an extension to you wireless PC connection, the connection (PC, PCMCIA card) needs a external antenna connector.
- Most antenna connections are pretty frail. Repeated connection of the antenna cable will take it's toll on the PC/modem connections.
- The cable used to connect your antenna will lose signal over long lengths. Larger cables have less lose but are harder to run.
- Remote antennas will mean large hole to pass the antenna ends through the side/roof of you rig.

External Antennas – Issues cont

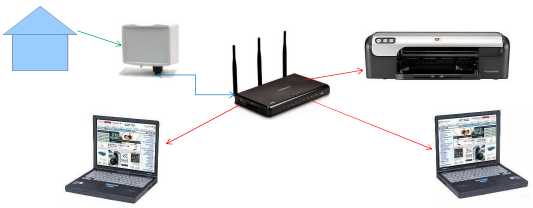
- External antennas have attached cables with larger (than CAT-5 cable) ends on them that will have to be routed into the RV
- There is a length limit on antenna cables that when exceeded you loose the benefit of the antenna. (Like 9'-15')
- In other words, connecting an external antenna to an air-card in a laptop is not a good solution.
- An external antenna is better connected to an air-card mounted in an air-card router.

Problems – Need for a local LAN



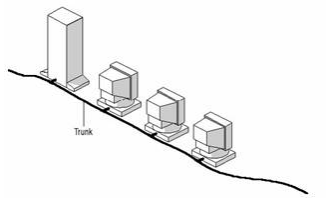
You can connect all your PCs and Printer to the Park Wi-Fi but your PCs won't be able to communicate to your printer

Problems – Need for a local LAN



By using a CPE (Customer Premises Equipment) radio to connect to the Park Wi-Fi and connecting your wireless router to the radio, your PCs and Printer can communicate on you local LAN and to the Internet via the CPE. Also, using a router with an Air-Card extends that connection to all PCs.

Basics - Ethernet



The original Ethernet was really never a loop but the terminology was attached to indicate a cable with devices attached.

All devices on the loop (cable) had to have the same base Address

Basics – IP Address

An Internet Protocol (IP) address is displayed in four groups of numbers. Each group ranges from 0 to 255

192.168.0.1

This part of the address indicates that it is an internal address, not viewable from the Internet

This part of the address indicates a loop or node

This part of the address is unique for each device on the network

Basics – IP Address

There are a couple of IP address ranges that are used for local LANs.

192.168.0.1

10.0.0.1

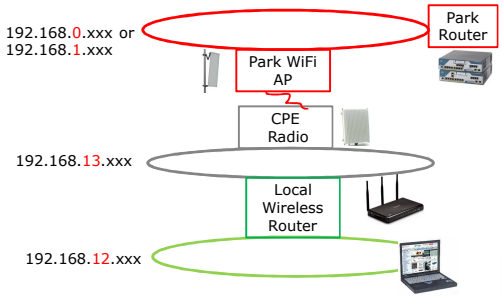
These ranges are also used by the park Wi-Fi

Basics – Router

The purpose of a Router is to connect two IP loops together.

The importance of a router to you is that is takes an IP address on the external side and changes it into one or more IP addresses on the local side.

Basics – IP Address Assignment



Each loop needs to have a different loop address

Basics – Router LAN IP Range

Since the park Wi-Fi will often use 192.168.0.n or 192.168.1.n ranges, it is good for you to use an IP node that is much higher, like 192.168.11.n

Note: some routers like the WIFIRanger use a default local IP address scheme that takes care of the issue of having the same IP address as the Park AP.

Problems – Air-Card Router

An air-card router represents many positives to using an air-card for the Internet.

- Easy of cabling
- Multiple PC interfaces

The disadvantage of using an air-card router is that instant statistics on data usage is not available as these numbers are generated by a PC when the air-card is plugged in.

When using an air-card router, you have to rely on the web statistics which usually lag by a couple of hours.*

CPE Radios

CPE (Customer Premises Equipment) radios are basically wireless routers in reverse. They take wireless traffic and turns it in to wired traffic.

They come Comes in two basic formats.

An integrated unit with the radio mounted inside a directional flat panel antenna. Has to be aimed.

A connectorized radio that is attached to an antenna. No aiming if used with an omni antenna.

CPE Radios - Wiring

How are they wired?

They use Cat-5 Ethernet cable (4 twisted pairs) from your router to the radio. Cat-5 cable is available is outdoor rating and is easy to run because it is relatively thin.

Cat-5 wire is limited to 385', more than enough to run around your RV.

If the CPE radio is an integrated unit, that is the total wiring.

If the CPE radio is connectorized, then an antenna cable is run from the radio to the antenna on the roof.

WISP Radios - Power

How are they powered?

They use Power over Ethernet injectors

There are 8 wires in the CAT-5 (Category 5, a specification) cable. The Ethernet signal uses only 4.

Two other wires in the cable carry the power.

The POE Injector has a small power brick and two RJ-45 (8 wire) jacks. The CAT-5 cable to the CPE radio plugs into one, another CAT-5 cable to your router into the other.

RJ-45 connectors are installed like phone wire ends. Be sure the RJ-45 ends are for round wire.

Enhanced Air-Card

Air-Card Problems –

- Too Far Away
- Interference
- Need for multiple PC connections

Problems – Too far away

- Most people relate their air-card problems to reception.
- Actually, the problems are generally related to transmission. The cell towers have more power and are located higher than you.
- The ability for your air-card to receive is far better then the ability of your air-card to transmit back to the cell tower.
- Generally your air-card has a better chance of communicating with the cell tower than your cell phone. Your air-card is powered by the PC while your cell phone relies on its batteries and therefore is conservative on transmission power usage.
- A big issue is how close to the cell tower are you. In other words, what is the coverage of your carrier?

Problems – Too far away

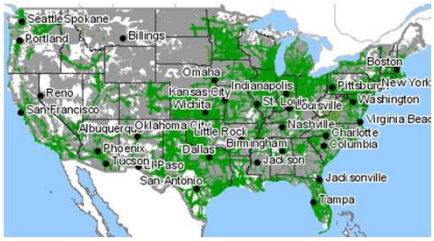
- AT&T, "We cover 97% of Americans
  - 97% of Americans does not map to geographic area coverage.
  - RVers tend to be away from large metropolitan areas.
- Interstate highways have good coverage
- National Park land is very poor on cellular coverage

Problems – Too far away

Our 2010 Trip

Problems – Too far away

Sprint Wireless



Problems – Too far away

Sprint Wireless with trip

Problems – Too far away

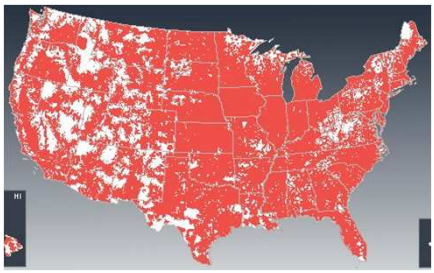
AT&T Wireless

Problems – Too far away

AT&T Wireless with trip

Problems – Too far away

Verizon Wireless



Problems – Too far away

Verizon Wireless with trip

Problems – Too far away

The coverage of your carrier will have a great effect on your ability to receive an air-card signal.

Cell Amplifiers

- Cell amplifiers compensate for the low transmit power of the air-card.
- Cell amplifiers need an external antenna.
- There are two types pf cell amplifiers.
  - Wireless
  - Wired
- Current call amplifiers will not handle the emerging 4G networks as the frequencies are different..

Cell Amplifiers - Wireless

- Wireless cell amplifiers can be used with cell phones as well as air-cards.
- Wireless cell amplifiers use an inside antenna as well as an external antenna.
- The wireless call amplifier is sending and receiving on the same frequencies inside as well as externally.
- Because the same frequencies are used, the inside antenna and the external antenna need a significant separation of they will step on each other.
- The inside antenna needs to be very limited to achieve the inside/external separation.

Cell Amplifiers - Wireless

Since the inside antenna and the external antenna are on the same frequency, they need to be separated.

With the external antenna in the back, the useful inside zone is near the front of the RV.

Cell Amplifiers - Wired

- Wired cell amplifiers can be used with one device, either a cell phones or an air-cards, at a time.
- Wired cell amplifiers use a cable to connect to the cell phone/air-card and an external antenna.
- Since sending and receiving is only done with the external antenna, there is no issue of antenna separation.
- Since the device is cabled to the cell amplifier, a fixed location for the air-card is preferred, as in an air-card router.

Cell Amplifiers - Wired

With a wired cell amplifier connected to your air-card and the air-card installed in an air-card router, the usefulness off the Internet is extended to the entire RV and a large area around it.

Recap

- External Antenna
- WISP Radio
- Wired Amplifier
- Router for local LAN

Evolution In Integration

Evolution in Integration

For people with Air-Cards, using a router capable of using the Air-Card makes sense. A CPE radio can be connected to the WAN (Wide Area Network) Port of the Air-Card router. The router can then be configured to use the Wi-Fi when available and the Air-Card when Wi-Fi isn't available.

Many Air-Card users have purchased CradlePoint routers for their Air-Card Capabilities.

Adding a CPE radio can be added.

The two devices are managed separately.

Evolution in Integration

The WIFIRanger is a new product that makes the use of an Air-Card and Wi-Fi even easier.

In its basic mode, the WIFIRanger is a Wi-Fi repeater. It connects to the park Wi-Fi and then connects to your PCs.

In this mode, the WIFIRanger does improve park Wi-Fi reception a bit, but the WIFIRanger alone, is subject to the same issues of Interference that your PC has inside the RV.

Adding the WIFIRanger Boost(actually a Bullet CPE) the reduction of Interference issues is accomplished (roof antenna) while management of the CPE is integrated into the router management.

Integration - Recap

- WIFIRanger

Discussion