Antennas for The Villages

Tonight's review of the antenna members have used

Tonight's list of antennas will cover

• Multiband Antennas HF, 6M and some 2M/70cm
• Presenting the implementation for most used
• Description of layout with key PROs and CONs
• This is a shopping list, not DIY which will be in future presentations

Factors to be considered

This is not the end all list, but the important issues

• RF Radiation Efficiency
• Installation
• Stealthy-ness
• Impedance Matching
• Cost
Small Antennas are a **Compromise**
Stealth Antennas are a **Compromise**
Multiband Antennas are a **Compromise**

### Antenna Design Rules

**Pick one from the list below:**

- You can make an HF antenna physically **small**
- You can make an HF antenna radiate **efficiently** at low angles
- You can make a **broadband** HF antenna with a wide VSWR Bandwidth

**THIS PRESENTATION IS STEP ONE OF YOUR PLAN; FINDING A SOLUTION FOR YOUR OPERATING BANDS/MODES**

Terrafugia was approved by the FAA in June 2010, price $200,000.

**A Flying car is a compromise**

**With the right compromises and some extra effort all three are possible**
Modes & Bands

The right planning requires each operator to think about which modes they want;
• SSB will require the best RF Efficiency available
• CW can operate on marginal RF Efficiency
• Digital can operate on marginal & poor RF Efficiency

The right planning requires each operator to think about which bands they want;
• 160M & 80M
• 40M, 30M & 20M
• 17M, 15M, 12M, 10M & 6M

The right planning requires each operator to think about how each antenna presented can fit within your landscape
• Palms or Shade Trees?
• Villa Fences?
• Screen Enclosures?
How Much “Punch” Can You Get from Different Modes

QST Dec 2013, P30-32

“You can target the DX station's operating mode more confidently when you know CW can out perform unprocessed SSB by 17 dB and RTTY can out perform SSB by 11 dB. If you can't get them on phone, try RTTY or better still, try CW.”
Modes & Bands

Remember your mode is the dominant factor, then review the band performance to select your antenna. The important message is what is the “best” antenna for you is not the “best” for someone else!
Read every book on antennas or use Villages Antenna Guide to narrow the list

### Villages Antenna Guide

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### “Villages Antenna Guide” is your shopping list

February 19, 2015
How does my Mode matter to my antenna?

“F” will work

Digital depends on the specific mode
- JT-65 works on almost anything
- PSK-31 works well with a C or D grade
- RTTY requires a B grade for solid copy

“ON AIR”

CW will be successful with a C or D grade

SSB will require an A or B grade in most cases

Ever wonder why antenna ads rarely state modes?

I have your XYZ up for about month and I am busting pile ups everywhere and receiving 59’s every time : - )
Flagpole

“Shorten” or “Loaded” Monopoles

Flagpoles can easily be used as a 21 Foot Vertical
Planning is important factor in disguising your remote tuner
A minimum of 32 radials for an efficient RF
Flagpole

### Before we start what does the summary antenna chart mean?

Factors are graded A best to F least, just like school

- **On Air** is the average RF Radiation Efficiency for 40M – 10M (most people)
- **Each band** is graded based on the radiating element size, height vs WL
  - Each person can decide which bands are important to them
- **Stealth** is graded on how invisible or non-antenna like the appearance
- **Tuner** is the tuner location that drives the cost, site plan and landscaping
- **Install** is the how much work is needed; like radials and landscaping
- **Cost** is graded A for least to F most expense;
  - Example the flagpole gets an “F” for high cost as it requires many costly items
    - Radials $200 - $300
    - Pole & Flag Kit $100 - $200
    - Remote Tuner $300 - $400
    - Underground feed line & protective conduit $?
    - Underground Power for Tuner $?
    - Landscaping $?

- This is a shopping list, not the DIY which will come in later presentations
Stealth

Stealth comes in two forms;

• Hiding in plain sight by looking like a common object (Flagpole)
• Hiding in by being almost invisible (#28 AWG wire)
Flagpole

“Shorten” or “Loaded” Monopoles

Be sure to do a site plan

• Radial Placement
• Feed line runs
• Concealing your tuner
• Access for maintenance
• Power for remote tuner
• Power for landscape lighting

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Flagpole

“Shorten” or “Loaded” Monopoles

The installation needs to look like a Flagpole
Today’s neighbors don’t care next year brings a different answer
The best rule is not to look like an antenna

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PRO
- Stealth
- On Air

Flagpole
“Shorten” or “Loaded” Monopoles

A minimum of 32 radials for an efficient RF is step one

CON
- Cost
- Install

Invisible Dog Fence installers charge $200 - $300

Using an edger and hand installation costs only the wire

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QST, March 2010, P 30-33
One of the best ideas for disguising your remote tuner is a fiberglass water well pump cover

Keeps electronics hidden, dry and accessible later

**PRO**
- Stealth
- On Air

**CON**
- Cost
- Install

“Shorten” or “Loaded” Monopoles

Dekorra 30-in x 23-in Well Pump Cover
Lowes Item #: 307793 $54.98
Flagpole

“Shorten” or “Loaded” Monopoles

Depending on the size and shape of your base equipment the disguise your can be made from plastic privacy fencing components. Keeps electronics hidden, dry and accessible later.

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PRO
- Stealth
- On Air

CON
- Cost
- Install
Flagpole

“Shorten” or “Loaded” Monopoles

Testing before digging is a great planning tool
A tripod with a fishing pole will give you on air performance
Experimenting with radials before digging has advantages

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## Flagpole

“Shorten” or “Loaded” Monopoles

The simplest solution could be a hidden tilt up antenna

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2014 Hidden Antenna Award Winner
Wayne N4FP
Before the next antenna

Now that the summary chart and planning considerations for any antenna has been explained the rest of the presentation will be antenna descriptions with any special considerations.
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</table>
Base loaded vertical normally used as mobile antennas. The small size gives stealth, you may “plant” a screwdriver in the garden without drawing attention to it. Adding band extensions to increase performance and use as many ground radials as possible.

<table>
<thead>
<tr>
<th>Antenna</th>
<th>On Air</th>
<th>Stealth</th>
<th>Tuner</th>
<th>Install</th>
<th>Cost</th>
<th>6M</th>
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More Screw Driver

“Shorten” or “Loaded” Monopoles

Antenna mounted at inside corner of screen cage to obscure view then painted to match cage frame and roof.

Screwdriver mounted to corner of cage
Radials & hardware match roof color
Fishing Pole
“Shorten” or “Loaded” Monopoles

This is just a simple 20 foot crappie pole propped up against fence or any object disguise your antenna.

**PRO**
- More stealth on patio

**CON**
- Where to put Radials

Surround the bottom of the pole with an old fishing tackle box to provide your antenna with visual effect

| Antenna       | On Air | Stealth | Tuner | Install | Cost | 6M | 10M | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|---------------|--------|---------|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Fishing Pole  | B      | C       | Remote| D       | C    | C  | B   | B   | B   | B   | A   | A   | A   | C   | D   | D   |
more Fishing Pole
“Shorten” or “Loaded” Monopoles

Many options for stealth
• Tilt up
• Tripod
• PVC Poles
• Clamp to railing

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</table>
Trapped Vertical Antennas

**PRO**

- Wide VSWRBW
- "Shorten" or "Loaded" Monopoles

The HF6V antennas are easy to erect and tune antennas that will last you for many years. Butternut HF6V antennas work six bands—80, 40, 30, 20, 15, and 10 meters—with an extremely efficient vertical radiator that's only 26 ft. tall!

The traps are low pass filters that make the antenna electrically shorter as frequency increases to maintain a lower VSWR but reduces On Air performance.

**CON**

- On Air

Tapped verticals are often hidden inside PVC Flagpole for stealth.

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more Trapped Vertical Antennas

“Shorten” or “Loaded” Monopoles

Traps lower efficiency on lower frequencies
Separate elements are an alternative to traps
Elements are separated to stop coupling
Works like a “Fanned Dipole”

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Palm Tree Caged
Monopole with Radials

- Palms can be 30 to 40 Feet and do better on 80M & 160M than Flagpoles limited to 21 Feet
- Disguising your remote tuner in plain sight as electrical equipment for your lights
- Radiating element can be Xmas lights or Gray-Brown wire to form a “Caged” radiating element
- Still need many radials for an efficient RF

**PRO**
- Stealth
- On Air

**CON**
- Cost
- Install

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A “cage” antenna is electrically a cylindrical conductor that appears electrically as a much larger and longer single conductor providing greater bandwidth / SWR. It can be shorter physically and was often used on ships with limited distance between masts for HF into the 1960s. The use of higher frequencies and availability better tuners resulted in the cage fading away.
Rain Downspout
“Shorten” or “Loaded” Monopoles

Rain downspout antenna is a difficult install job
- The gutter and downspout are isolated from ground
- Electrical continuity between sections of your downspout is a maintenance problem
- Coupling to the house, aluminum window and screen cages detunes
- Success has been at 2 or 3 story homes

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**PRO**
- Stealth

**CON**
- On Air
- Install

Poor Conductivity

Remote Tuner

3 Story House
Before the next antenna

Newer homes are being made with aluminum roof sheathing. Basically plywood or OSB sheathing with a thin aluminum facing on one side as a radiant heat barrier. The aluminum blocks RF and precludes many of the attic antenna installations for homes south of 466.
**Dipole**

Center-Fed-Dipoles - ½ Wavelength

- ½ WL dipole oriented horizontal and center fed
- Resonate 40M and 15M is ~ 65 Feet Long
- May take many shapes to fit in attic space
- 2.16 dBi perpendicular in free space
- NVIS at ten feet above ground drop to -9 dBi
- Attic is most common installation

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More Dipole
Center-Fed-Dipoles - $\frac{1}{2}$ Wavelength

- Color is key to stealth
- Location can be under soffits or over shingles
- Straight lines are not required
- Multi-antennas required for matching
- Primary & Odd Multiples are resonant

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**Inverted Vee**

*Center-Fed-Dipoles - ½ Wavelength*

“Birdhouse Antenna”
- Elements “support” the birdhouse pole
- Birdhouse covers feed point & coax in PVC pipe
- Tell everyone how much you love bird watching!
- Less NVIS than attic or roof Dipole

**PRO**
- Cost

**CON**
- Stealth

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**40M**
- 22 Ft Tall
- 50 Ft Wide

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**Antenna**

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*February 19, 2015*
G5RV Jr
Center-Fed-Dipoles - ½ Wavelength

PRO
• Cost

CON
• On Air
• Install

G5RV popular multi-band "compromise" antenna
Ladder Line must be in free space and vertical
Demands better tuner than dipole or OCF

Invented in 1946 by Louis Varney, G5RV (SK)

<table>
<thead>
<tr>
<th>Antenna</th>
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G5RV Jr
Center-Fed-Dipoles - ½ Wavelength

Issue - Ladder Line must be in free space

Ladder Line should be installed away from objects

Do you have 15 Ft away from objects?

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G5RV Jr

Center-Fed-Dipoles - ½ Wavelength

Issue - Ladder Line must be in free space

Ladder Line should be installed away from objects

G5RV intended for Free Space

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</table>

February 19, 2015

TVARC Antenna Guide for The Villages 36
## G5RV Jr

**Center-Fed-Dipoles - \( \frac{1}{2} \) Wavelength**

**Issue - Ladder Line must be in free space**

<table>
<thead>
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</tbody>
</table>

Ladder Line should be installed away from objects. G5RV intended for Free Space.
Buddipole

Center-Fed-Dipoles - “Loaded” Dipole

Two short elements on a tripod
Tuned by base loaded elements
40M-6M & 2M by changing coils
16 Ft Wide X 10 Ft Tall
~ $500 as shown

Antenna On Air Stealth Tuner Install Cost 6M 10M 12M 15M 17M 20M 30M 40M 80M 160M
Buddipole D C Shack B C C C C D D F F F F

PRO
• Backpack
• Portable

CON
• On Air
• Cost
**Slinky Dipole**

Center-Fed-Dipoles - “Loaded” Dipole

Two shorter loaded elements
Tuned by stretching (var. Inductor)
40M-10M with tuner
Size to fit space available
Acts like a base load

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</table>

**PRO**
- Cost

**CON**
- On Air

---

**Ideal**

Simple ¼ wave dipole

**Worst**

With base loaded inductor

**Better**

With centre loaded inductor

**Best**

With capacity hat

50 Ω coax
**Helical-Coil Dipole**

**Center-Fed-Dipoles - “Loaded” Dipole**

**The Dowsers Corner Our COAX Stealth Helical**

- Shipping Insur. & Del. Conf. Included
- From QRP up to 100W on Xmit
- 10M thru 80M in as little as 15'-20' of space!*
  - It's a Real FULL SIZED Helical Dipole (approx. +/- 130') all coiled up!!!
  - Simple permanent or portable mounting!
    - Indoors ~OR~ Outdoors

**PRO**
- Cost

**CON**
- On Air

---

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</table>
**Wound Vertical Dipole**

Center-Fed-Dipoles – “Loaded” Dipole

Vertical has less NVIS than Horizontal

Tuned by adjusting elements

40M-10M, 80M by adding coil

20 Ft Tall wire around a fishing pole

~ $50 as shown

---

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</table>

**PRO**
- Install

**CON**
- On Air

---

Ideal

Worst

Better

Best

Simple ½ wave dipole

With base loaded inductor

With centre loaded inductor

With capacitive load

50 Ω coax

50 ohm transmitter tuner
Wound Vertical Dipole

Center-Fed-Dipoles - “Loaded” Dipole

“TransWorld Adventurer”
Tuned by matching network
20M-10M by switching network
5 Ft Wide X 8 Ft Tall
~ $800 as shown

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PRO
- Backpack
- Portable

CON
- On Air
- Cost

Ideal

Worst

Better

Best
**Fence Dipole**

Direct Driven Ring Radiator

Featured in QST as Stealth 80M – 160M NVIS design
Not for 40M & up
5 Ft High X 62 Ft Long

**PRO**
- 160M

**CON**
- On Air

---

*Figure 1 — Sketch of an 80-meter DDRR-like top-wire loaded vertical monopole mounted on a privacy fence. As noted, it can give a good account of itself, considering its visual impact and cost.*

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</table>
**TAK-tenna**

**Center-Fed-Dipoles - “Loaded” Dipole**

Two short elements with end loads
40M-6M
3 Ft Wide X 3 Ft Tall
~ $180 in Kit Form

**PRO**
- Install

**CON**
- On Air

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February 19, 2015
**Off-Center-Fed Dipole**

“Off-Center-Fed” Dipole

Multi-band "compromise" antenna like G5RV

- No Ladder Line, so easier to install than G5RV
- Easier to match than dipole or OCF for 30M, 17M & 12M
- Resonate 40M, 20M, 15M & 10M ~ 65 Feet Long
- May take many shapes to fit in attic space

| Antenna          | On Air | Stealth | Tuner | Install | Cost | 6M | 10M | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|------------------|--------|---------|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Off Center Fed   | C      | C       | Shack | B       | B    | C  | C   | C   | C   | C   | C   | D   | D   | F   | F    |

**PRO**
- Cost

**CON**
- On Air

**40M**
67 Ft Long (1/2 WL)
PRO
• Cost

OCF DP also called a **Windom Dipole**

“Off-Center-Fed” Dipole

Multi-band "compromise" antenna like G5RV
No Ladder Line, so easier to install than G5RV
Easier to match than dipole or OCF

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<td>D</td>
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</table>
**Inverted-L**

“Vertical” with Radials

Thin wire which is hard to see from a distance
Typically 20 Ft vertical then horizontal to tree
Length determines lowest frequency

**PRO**
- On Air

**CON**
- None?
- You decide!

\[
\frac{1}{4} \text{ WL} \\
60 \text{ FT} = 80\text{M} \\
125 \text{ FT} = 160\text{M}
\]
End Fed “Dipole”

“Off-Center-Fed” Dipole

Thin wire which is hard to see from a distance
Typically 20 Ft vertical then horizontal to tree
Length determines lowest frequency
Element ~ 92% of ½ WL
Counterpoise ~ 8% of ½ WL

PRO
• On

CON
• Length

120 FT = 80M
230 Ft = 160M

40M

67 feet of wire
From end of ladder line

Ladder Line can be used for matching & counterpoise

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</table>
End Fed “Dipole”

DX Engineering Auto-Tuned Multi-Band HF Stealth Antenna

“Thin wire which is hard to see from a distance…”

… No antennas allowed? DX Engineering Auto-Tuned Multi-Band HF Stealth Antenna Systems help you keep a low profile and still get on the air! Our ATSA concept allows Amateur radio operators living under the shadow of HOA-controlled areas to get on the air easily. “

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Random Wire

“Off-Center-Fed” Dipole

Many recommend lengths published

40M-10M Example = 84’ long end fed and a 17’ long counterpoise

QST, March 1936, P 32

One solution hide remote tuner & counterpoise under soffit
Random Wire can be run over roof or to tree

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PRO
• Cost

CON
• 40-160M
Flagpole-L

“Off-Center-Fed” Dipole

PRO
- On Air

CON
- Cost

Thin wire added to Flagpole
Small wire is hard to see from street
Flagpole for vertical then horizontal to tree
Length determines lowest frequency

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¼ WL
60 FT = 80M
125 Ft =160M
PRO
• Stealth

CON
• On Air

Rain Gutter Dipole

"Off-Center-Fed" Dipole

Very NVIS Antenna
• Rain Gutter antenna is a difficult install job
• Keep gutters are isolated from ground install wire on insulators
• Electrical continuity between sections is a maintenance problem
• Coupling to the house, aluminum window and screen cages detunes
• Low Res Z
  – 80M = 7 Ohms R + 0j
  – 160M = 8 Ohms R + 0j

| Antenna          | On Air | Stealth | Tuner  | Install | Cost | 6M   | 10M  | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|------------------|--------|---------|--------|---------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Rain Gutter Dipole | D      | A       | Shack  | C       | C    | F    | F    | D   | D   | C   | C   | C   | D   | D   | D   | D    |
**Off-Center-Fed Spiral Dipole**

“Off-Center-Fed” Dipole - “Loaded” Dipole

Two short elements with end loads
40M-2M
3 Ft Wide X 3 Ft Tall
~ $10 in Kit Form

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</tbody>
</table>
**WL Horizontal Loop**

Full Wavelength Loop

**PRO**
- None?

**CON**
- Install

Very NVIS Antenna
- Depends on available trees
- Require 60 Feet above ground to work properly
- Low Res Z at 10 – 20 feet above ground

<table>
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**TVARC Antenna Guide for The Villages**

February 19, 2015
**PRO**
- Stealth

**Rain Gutter Loop**

Full Wavelength Loop

**Very NVIS Antenna**
- Rain Gutter antenna is a difficult install job
- Keep gutters are isolated from ground install wire on insulators
- Electrical continuity between sections is a maintenance problem
- Coupling to the house, aluminum window and screen cages detunes
- Low Res Z
  - 80M = 7 Ohms R + 0j
  - 160M = 8 Ohms R + 0j

**CON**
- On Air

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</table>
**WL Vertical Loop**

Full Wavelength Loop

Good on the Air Performance Sitting on Ground
Almost Omni-Directional
Wide VSWR range (no tuner)
Cheap (wire + fishing pole + BALUN)
Low visibility

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**PRO**
- On Air

**CON**
- 80-160M
### WL Vertical Loop

**Full Wavelength Loop**

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**Vertical Loop ~150 feet 80M – 6M**
Stealth for Sale

Stealth in a box?
• SG-237 Smartuner
• 80 foot wire.
• Rope
• Cable ties

$400
# Magnetic Loop

**Short Loop**

| Antenna     | On Air | Stealth | Tuner | Install | Cost | 6M | 10M | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|-------------|--------|---------|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Magnetic Loop | C      | A       | F     | B       | D    | C  | C   | C   | C   | C   | C   | C   | C   | C   | D   | D    |

---

February 19, 2015

TVARC Antenna Guide for The Villages
Magnetic Loop

Short Loop

Short magnetic loops are less than 10% of a wavelength
Magnetic loop does not look like an antenna
Shape can be a circle, rectangle, square, etc. more area helps
RF Efficiency 10% & advanced DIY skill

Thousands of RF Amps require pipe conductors
Thousands of RF Volts require vacuum capacitors for tuning
10 KHz VSWR Bandwidth

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**PRO**
- Stealth

**CON**
- Cost

QEX March 2013 P 3-6
# Magnetic Loop

**Short Loop**

MFJ-1786 Loop 30M-10M sells for $500

| Antenna       | On Air | Stealth | Tuner | Install | Cost | 6M | 10M | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|---------------|--------|---------|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Magnetic Loop | C      | A       | F     | B       | D    | C  | C   | C   | C   | C   | C   | C   | D   | D   | D   |
**Magnetic Loop**

**Short Loop**

Most Magnetic Loops are DIY

Thousands of RF Amps require pipe conductors

| Antenna | On Air | Stealth | Tuner | Install | Cost | 6M | 10M | 12M | 15M | 17M | 20M | 30M | 40M | 80M | 160M |
|---------|--------|---------|-------|---------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Magnetic Loop | C | A | F | B | D | C | C | C | C | C | C | C | D | D | D |
Magnetic Loop

Short Loop

Most Magnetic Loops are DIY
Thousands of RF Volts require vacuum capacitors for tuning

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**Magnetic Loop**

**Short Loop**

QRP Magnetic Loops are often made from coaxial cable or wire.

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**Magnetic Loop**

*Short Loop*

Short Magnetic Loops can be used as horizontal loops for short range 200 to 400 Miles NVIS theater communications.

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Magnetic Loop

Short Loop

Vertical or horizontal loops mobile communications

Stealth Telecom 9400 Mobile HF NVIS Magnetic Loop Antenna

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$5,000

Autotuner

Mag Loop

Stealth Telecom

9400 Mobile HF NVIS Magnetic Loop Antenna

$5,000
**Magnetic Loop**

*Short Loop*

Vertical DIY loops mobile communications

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February 19, 2015
**2M / 70cm**

The Villages have good 2M & 70cm repeater coverage
Most can reach one or more repeaters from an HT
An attic antenna will reach the five Sumter repeaters
Newer homes with aluminum roof sheathing require stealth antennas

**PRO**
- Cost

**CON**
- None?
**Arrow J-Pole**

Covers 143-148 MHz. VHF
Covers 437-450 MHz. UHF
With an SWR of less than 1.5 - 1

**Simply the Best**

Does NOT require a ground plane.
Mount on a metal mast
Ideal for mounting in an attic,
On a roof vent pipe, (up to 1 1/2")
On a wooden or Fiberglass pole,
On Fiberglass or Plastic Vehicles,
(Motorhomes, Trucks, **Boats**) Mount it just about anywhere.
Low SWR - Wide Bandwidth
Has Gain over a 1/4 wave.
Omni-Directional.

This is a very Heavy Duty Antenna. The Elements are made from 3/8"
Solid Round Aluminum with a Heavy Duty Angle Mounting Bracket.
Mounting Hardware for mast up to 1 1/2" Included.

**PRO**

- Cost

**CON**

- None?

$70
2M / 70cm

Most 2M & 70cm antennas will fit inside PVC pipe & mount as a vent pipe

Ventenna VT-27 2M/440 Dual Band $120

Hide in plain sight
2M / 70cm

Most 2M & 70cm antennas will fit inside PVC pipe & accent with a plastic weather vane.
2M / 70cm

More 2M & 70cm antennas stealth options; hiding as a potted plant or staked tree, climbing vine, etc.
Antennas for The Villages

Modulation matters more than your antenna or power output
- AM vs. SSB vs. CW vs. PSK vs. JT65
- 5 W using CW equals 250 W using SSB
- 5 W using PSK-31 equals 2,500 W using SSB
- QST Dec 2013, P30-32

Height (of Dipoles, G5RV, End Fed) matters, except Vert Loops
- Horizontal elements near ground are NVIS

Short Antennas hurt RF Efficiency
- Loads at base hurt, top loads help, top caps help
- Traps hurt lower frequencies

1 Counterpoise above ground = 32 Radials
- Poor soil conductivity hurts radials as counterpoise

Some timeless approaches for better RF performance
- Anything Tall Helps (except Vertical WL Loops any height works)
- Longer is better (monopole objective is ¼ WL or odd multiples, ½ WL for dipoles)
- Inverted-L address lower frequencies (160M-40M)
- Vertical WL Loops address most HF bands (80M-10M)