# Stealth HF Antennas

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April 4, 2025

# Stealth HF Antenna

- My background in pursuing Stealth HF antennas
  - Anyone in HOA detached home, townhome, condo or an apartment?
- Stealth means different things dependent on home environment
  - Indoor Antennas (recommend max 100W)
    - Can't be in Faraday cage
    - Work in typical room size
    - Windows or balconies expand options
  - Attic Antennas-access needed
    - Can't have radiant barrier insulation
  - Stealth Exterior Antennas
    - Nearly invisible or disguised visually

# My long Stealth antenna history

- Licensed 1968, first stealth antenna 1968 at age 12, parents vacation townhome, 1 story attic 40M dipole-fair to poor performance
  - Who cares about performance, I was a Novice using CW making some contacts, no DX
- Operated from 14 homes (primary or vacation homes) during past 57 years
  - 7 homes in HOA's- Detached single family homes and townhomes
- Not a technical PHD so examples based on experimental results and modeling- Tried about 95% of the antennas in my briefing

# Stealth Antenna Principles

- Minimize or better eliminate loading for improved efficiency
  - Linear load when possible vs higher loss coil loading
- Have high current portion of antenna as high as possible and as far from large metal objects
- Evaluate methods to lower angle of radiation and reduce losses
  - Choose between Vertical vs Horizontal radiation based on height and location and large metal surroundings
  - Evaluate topography, organic masts or towers

# Big signal Stealth Stations

- W7CUI, Washington  59+10-20 on 20M during last few months
  - 100 watts, Luxury retirement home condo, retired Medical doctor, surgeon.  What antenna?
  - Secret sauce?

# Big signal Stealth Stations

- W7CUI, Washington  59+10-20
  - 100 watts, Luxury retirement home condo.  What antenna?
  - Yaesu Atas 120 screwdriver antenna on metal rail balcony-auto tunes with Yaesu transceiver
    - Estimate -3 db below reference dipole on 20M
  - 21st Floor- Height is might, very low angle radiation, no ground loss
  - Signal comparison-about equal to most Hex beams
  - Be creative to understand your environment and how to maximize

# Indoor Antennas (DIY)

- Mag Loop (Vertical 1st or 2nd floor, Horiz 3rd+)
  - Homemade 20 watt max, about $30. CONUS SSB QSO's primarily- RG-214 -2 to -4db reference dipole
  - Homemade 100 watt max about $50  0.6” to 1” copper or aluminum  -1 to -3 db reference dipole
  - Direct gamma or Mini loop fed, always tuning
- 9 ft Window or Balcony Vertical, loading coil.  100 watts. Counterpoise ¼ wire.  Used at hotels, motels about 100 countries worked. Recommend 2nd floor or higher, gain a S unit.  Keep losses low -1 to -3db down from full size Vertical.  Aluminum or copper 10 to 14 gauge coil

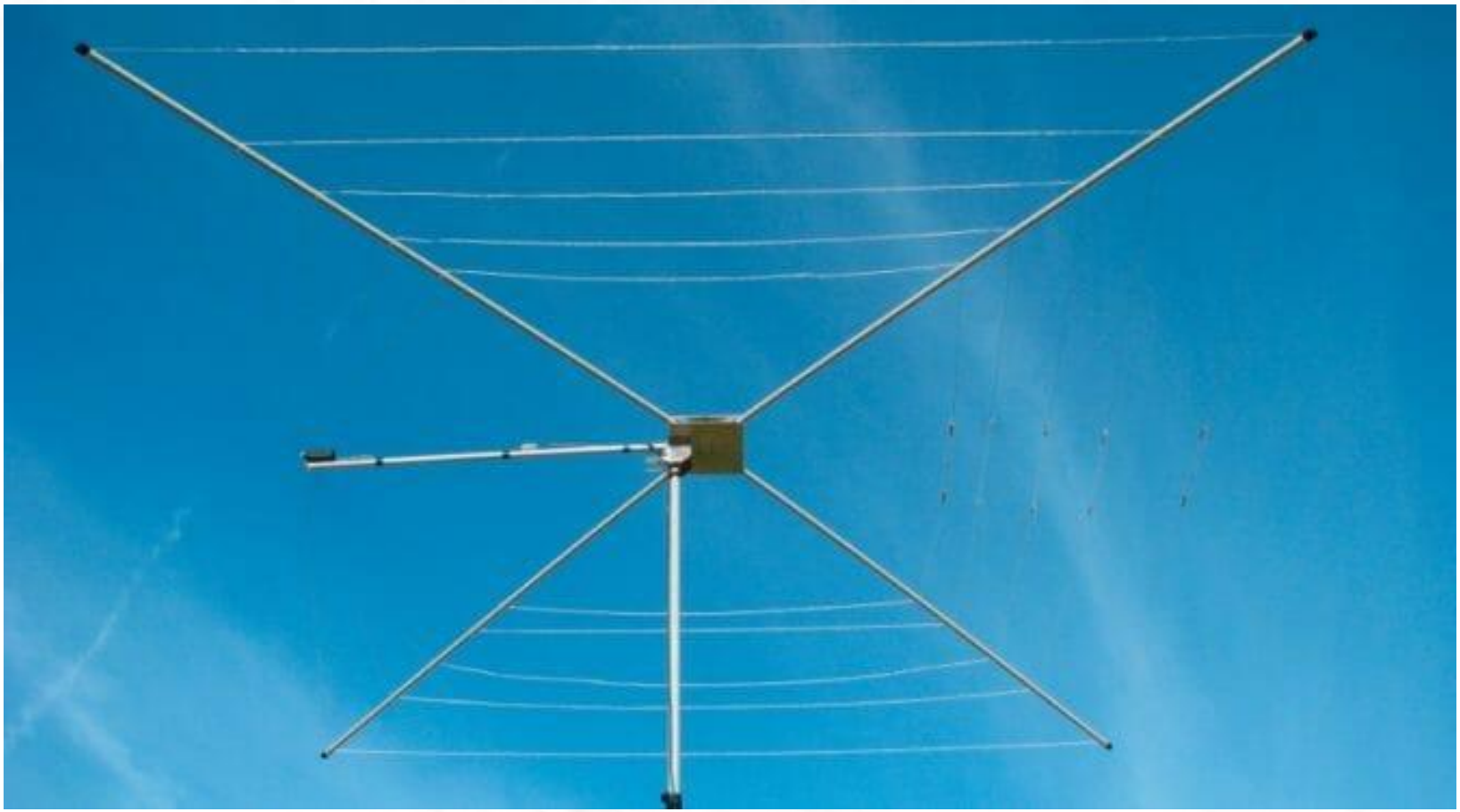
# Indoor Antennas (DIY)

- Wire Loop taped to ceiling edge, full perimeter.  ATU for multiband operation or resonant 1 wavelength loop 10, 15, perhaps 20M (linear loading)
  - 20M, 70 ft total, approximately 17' per side or can do any shape, linear load best at low current locations
  - 17M, approximately 55 ft total
  - 15M, approximately 46 ft total
  - 10M, approximately 35 ft total
- White 20 gauge wire to make it Stealth

# Indoor Antenna, Commercial cont.

- Ultimax100  24 ft antenna, Non resonant End fed 5 to 1 Unun
  - Works with most transceivers with ATU
  - SWR low to moderate 40M to 10M
  - About 1 or 2 S units below resonant dipole reported by users.
  - Use horizontal with good height.
  - Follow and tape a path indoors
- CobWebb antenna, 2nd floor or higher, ceiling
  - Fan Dipole folded, low impedance 4 to 1 balun
  - Omni, about -2db less than reference dipole

# Cobwebb antenna



# Stealth Attic Antennas

- Attic Antennas
  - Dipole (broadside peak)
  - Inverted V (near Omni)
  - **Full wave horiz.Loop (Omni, lower noise)**
  - Magnetic Loop (small, remote tunable, lower noise, small BW)
  - Large attic 40M End fed  66 ft (can zig zag)
  - ZR like Vertical (pg 126 FARS briefing)
  - Cobwebb (Omni) 4 to 1 balun feed
    - About 8 x 8 ft for 20, 17, 15, 12, 10M

# Force 12 ZR like Vertical or Horizontal

# Stealth Attic Antennas (cont)

- Tall attic  10+ feet
  - Vertical 1 Wavelength Loop 11 to 13 feet tall
    - 20M, 17M, 15M, 12M, 10M – 5 Loops
    - Vertically polarized fed at side
    - Low angle radiation about 20 deg
    - Low noise, about 1 s unit less than dipole
    - Omni
    - Should equal about 30 to 40 ft dipole
  - Inverted V fan Dipole 18 to 30 ft about ground

# Attic concerns

- No radiant barrier insulation or steel roofing
- Don't worry about ducts and roof type (composition, tar and gravel, tile)
  - Likely only 1-3 db effect
- Power line coupling. Use ferrite cores
- Suppress noise and interference concerns
  - Snap on ferrite cores and filters may be needed to reduce noise levels
  - Usually can achieve about S 2-5 depending on band.  Highest bands typically lower noise

# Attic-RF Noise detection

- Evaluate all appliances, even HVAC
  - S9 with modern Heat pump
    - Did filtering at Compressor and Air Handler
- Phone and computer switching supplies
  - S5 to S9+10, cores and RF power filters
- Florescent lights S4-S7
- Then there is the interference you may inflict
  - Security lights (AC line filters), TV's (high pass)
- Noise eliminators with 2nd antenna, phase adjustments needed- Avoid by suppressing noise sources

# Performance comparisons

- Full wavelength Attic Loop 23 ft high fed by homemade 2 to 1 balun. Commonly fed
  - 12 or 14 gauge teflon insulated silver plated wire
  - About 3 to 4 S units down from Optibeam 74 ft
    - About 4 dbi
  - About 60 countries primarily 20,17,15 some 10 meters during 3 years at vacation home (part-time)
  - 5/5 to 5/9 into Europe 100 watts
  - 5/5 to 5/7 Australia/New Zealand
  - 5/5 to 5/9 Asia

# Outdoor considerations

- First Floor
  - Vertical options
    - 2 to 3 ft high counterpoise
    - Don't recommend direct ground mount
      - Warms the ground
    - 8 to 30 ft base height = 2 to 4 db signal improvement
- Low profile (fiberglass mast), “Organic towers” trees 20 to 100 ft, or leverage building elevated mounting points 15 ft + high

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# Portable or Semi permanent Vertical

# Outdoor Stealth not recommended

- Center fed Dipoles, Inverted Vs, G5RV
  - Feedline becomes too visual
  - Supports need to support feedline and antenna wire
  - Multiband is challenging, such as fan dipole and/or ATU's
- Flagpole Vertical-only moderate efficiency due to ground mounted vertical needing 30 to 100 radials

Instead End feds utilize 49 to 1 Balun to match at end, easy to disguise stealth feedlines, only support lightweight Stealth antenna wire and are multiband

# Outdoor Stealth (DIY)

- End fed 20 gauge(1Kw) to 26gauge (100 watts) teflon insulated silver plated wire)
  - 40M, 66 ft  (40M, 20M, 15M, 10M) tune 7.06 mhz
  - 80M 132 ft (80, 40, 20, 17, 15, 12, 10M)
    - Quality supplier MyAntenna
- ZR like Vertical (about 5 ft tall vert on 2 ft stand). Even 8-10 ft will improve signal 1 to 2db
- Portable fiberglass rod vertical with Ring counterpoise

# Outdoor Stealth (DIY)

- Magnetic Loop (low loss-Semi permanent)
  - Home made 3 ft to 6 ft  (10 to 40M)
  - Vacuum variable or large air variable dual stator
  - Stepper motor to remote tune
  - Using tubing or large coax (LMR600 or hardline) about similar performance to dipole at 20 to 30 ft
- Intermediate Loop greater than ¼ wavelength loop, less variable capacitance, omni, high efficiency larger bandwidth

# Outdoor very stealth but limited to Ok performance

- Raingutter
  - Very dependent on rain gutter configuration and downspouts above ground
    - 4 to 1 to 9 to 1 Balun
    - Ground system
- Soffit antenna with Aluminum patio room as counterpoise
  - 10 to 15 ft high, 160M to 10M less than 2.5:1 SWR
  - NVIS +
  - 3 S units down from 40M end fed with DX
  - Only about 10 countries worked “neighboring DX”

# Outdoor 40M End fed

- Home made 49 to 1 Autotransformer
  - 10 gauge teflon insulated silver plated autotransformer about 0.2 db loss, 2kw rated

Using it at 35 ft, tree branch, 20 gauge black teflon insulated wire

- Know your lobes.  Look at models
  - 6 to 8 dbi 20 to 10M lobes
  - 2 to 3 S units less than Optibeam at 74 ft
- About 100 countries operating from vacation home over 3 years (part-time, 20%), 100 watts

# Outdoor Stealth (cont) Commercial/Disguisable

- Hamstick/Screwdriver Vertical $50 to $1,000
- Magnetic Loop
  - Home made 3 ft to 6 ft
  - QRO RF design or Ciro Italian remote tunable
    - $2,000 to $3,000
  - Using tubing or large coax about similar performance to dipole at 20 to 30 ft
- Isotron works about 5 to 10 db less than dipole
  - Coax shield major part of radiation
  - Single band versions $100 to $200
- ¼ or 5/8 wire vertical

# Outdoor Stealth (commercial)

- Magnetic Loop
  - Alpha Antenna, Alex Loop, MFJ  up to 100 watts
  - QRO  Precision RF, Ciro  $2,000 to $3000
- End fed Multiband 40M or 80M
  - My Antennas and several others
    - $120 to $280 dependent on power handling
      - 1 core vs 3 core and wire gauge
  - Dual End feds at 90 deg, 45 to 60 ft
    - Could spend easliy $1,000 total with dual antennas, coax, switch, installation

# Alternatives

- Mobile antenna on car with extension coax into home
- Remote station in non HOA environment or in the countryside operating from solar power
- Rental home on large county lot adjacent to HOA home development
- HOA home on the saltwater with boat dock and Multiband vertical

# Class exercise-Palo Alto townhome
# What would be your antenna choices be?

# Palo Alto townhome possibilities

- 3rd Floor Attic
  - 20, 17, 15, 12, 10 M Horizontal Loop 30-34 ft high
  - Magnetic Loop in attic Horizontal remote controlled
  - Rear balcony? 3rd floor Scorpion Screwdriver vertical with faraday cloth counterpoise on underside of balcony
  - 40M End fed from rear room balcony or eave to tree (apex) to fence
- Other options
  - Fan Dipole Inverted V 20,17,15,12,10 lots of attic time tuning, 40M zig zag at end (32 ft peak)
  - Magnetic Loop or Intermediate Loop on balcony
  - Raingutter antenna- antenna spans multiple townhomes on roof edge

# Antenna Comparisons

| | | | |
|---|---|---|---|
| Could be 2 to 4 S units better in US. Typically operating 100 watts and other station Dipole or Hex beam 30 ft | | | |
| Optibeam at 74 ft | 5 8 | Average signal early, peak, and late openings | $15,000 to $25,000 |
| Hex beam at 30 ft | 5 6 to 7 | | $2000 to $4000 |
| Indoor | | | |
| Magnetic Loop | 4 2 to 3 | Gain 1 S unit when operating from 2nd or 3rd floor | $100.00 DIY |
| ***Window Vertical*** | **5 3 to** 4 | Gain 1 S unit when operating from 2 or 3rd floor | $50.00 DIY |
| Wire loop on ceiling | 5 2 to 4 | Band dependent, 2nd floor or higher | $600.00 ATU |
| Dual Hamstick | 5 2 to 4 | Band dependent, 2nd floor or higher | $500.00 |
| Remote Tuneable Loop | | | |
| Mid priced | 5 3 | Gain 1 S Unit when operating from 2nd or 3rd floor | $1,000.00 |
| 'High priced exter | 5 4 | Gain 1 S unit when operating from 2nd or 3rd floor | $2000 to $3000 |
| Hamstick/screwdriv | 5 3 | Gain 1 S unit when operating from 2nd or 3rd floor, full counterpoise | $200.00 |
| Scorpion Screwdriv | 5 4 | Gain 1 S unit when operating from 2nd or 3rd floor, full counterpoise | $1,200.00 |
| Isotron with counter | 4 2 | Gain 1 S unit when operating from 2nd or 3rd floor | $700.00 Multiband |
| Ultimax End fed 24 14 | 2 to 3 | Gain 1 S unit when elevated from 2nd or higher floor ceiling | $100.00 |
| CobWeb | 5 3 to 5 4 | 2nd floor or higher | $100 DIY to $400 commercial |
| Stealth Attic | | | |
| Dipole | 5 3 to 4 | 20 to 25 ft high and broadside | $80.00 DIY |
| ***Inverted V*** | 5 3.5 | 20 to 25 ft high and broadside | $80.00 DIY |
| ***Full Wavelength L*** | 5 4 | 22 to 25 ft high feedpoint side max | $100.00 DIY |
| Mag Loop | 5 3 to 4 | Gain 1 S unit with high end loop | $300 to $3000 |
| 40M End fed | 5 4 | Band and Lobe dependent at least 20 ft high | $100 to $400 DIY |
| ***ZR like Vertical*** | 5 4 | Band dependent at least 10 ft at base | $150.00 DIY |
| ***CobWeb*** | 5 3 to 4 | 20 ft or higher | $150.00 DIY |

# Antenna Comparison cont.

| External Antenna | | |
|---|---|---|
| ***40 or 80M Endfed*** | 5 4 to 5 | At lead 35 ft high at Apex |
| ***Dual 40 or 80M Endfe*** | 5 5 to 5 6 | At least 45 ft high at Apex |
| Magnetic Loop- High e | 5 4 | At least 10 ft high Vertical, 25ft or greater Horizontal |
| Isotron | 5 3 | At least 20 ft+ |
| ***5/8 WavelengthVertic*** | 5 5 | Wire stealth vertical hung of 50 ft tree |

**You could estimate about $1,000 to $2,000 per S unit for Antenna or Amplifier (Antenna in**

***Better value options in Bold Italics***