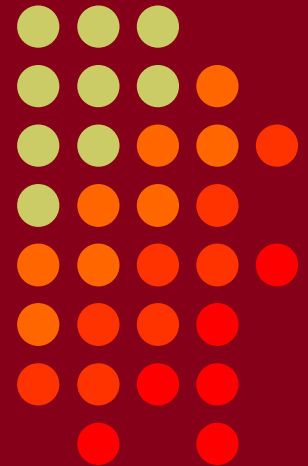


CTU Presents

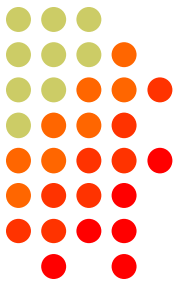
Feeding and Detuning Towers
Ward Silver, NØAX



• CTU •
CONTEST
UNIVERSITY

ICOM®

Overview



- Towers as Antennas – the Basics
- Ground Systems
- Base-feeding Towers
- Shunt-feeding Towers
- Detuning Towers
- Q&A



Towers As Antennas

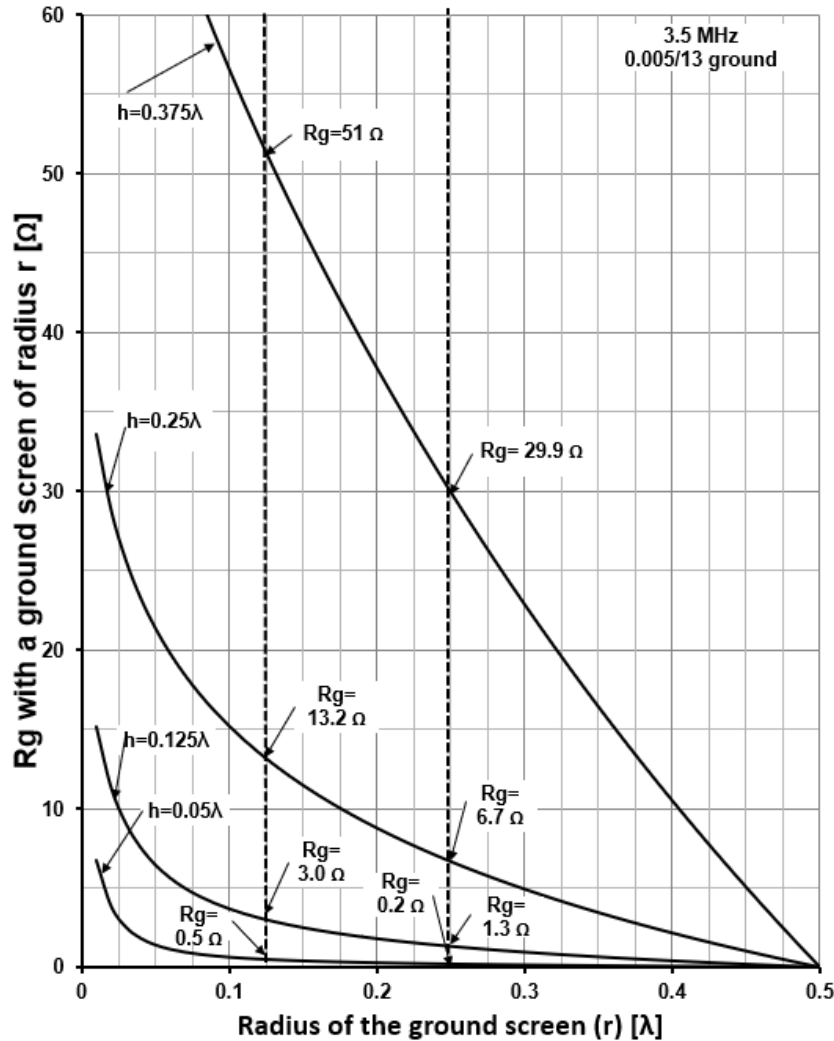
- You might already have one!
- Verticals or “monopoles”
- Used on 160 through 40 meters
 - $1/8^{\text{th}}$ - $1/2 \lambda$ are the most useful electrical heights
 - Any tower 30 feet or higher will work
- Beams and wires lengthen the tower
 - Mast “stingers” can extend the tower
- Highly empirical – experimenting required!

Ground System

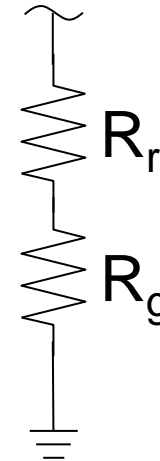


- Most important part of the antenna!
- Ground loss cannot be made up in gain
- Keep RF out of the dirt!
- Many dB to be gained from loss reduction
- Most important area around tower base
- See *Antenna Book*, Chapter 3
 - Effects of Ground

Ground System - Loss



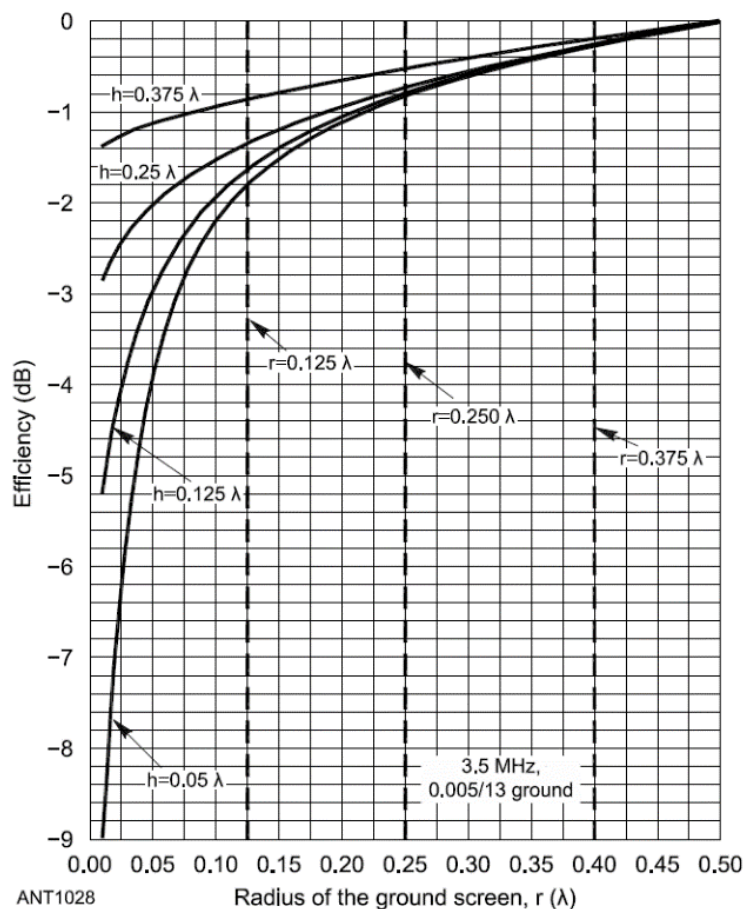
Power



Ground System - Loss



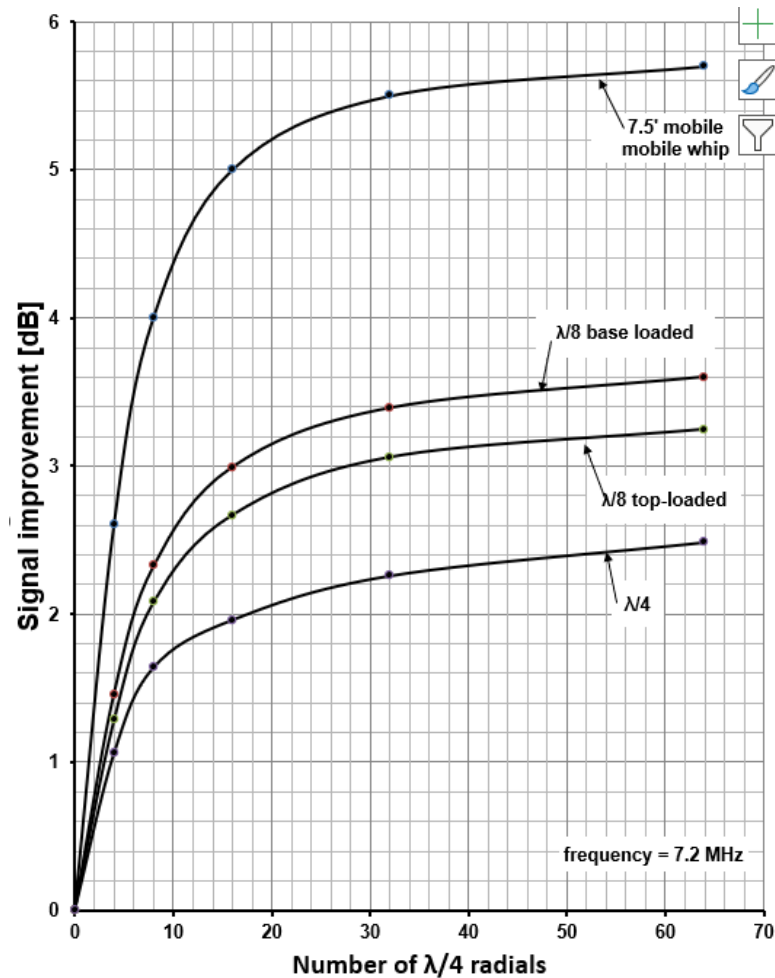
The change in efficiency for an 80 meter vertical as the radius of the ground screen is increased. Even for electrically short verticals (h represents antenna height in wavelengths), most of the improvement is obtained for a radius of $1/8$ wavelength. (Graphic from the *ARRL Antenna Book*, 24th edition, courtesy of the ARRL)



Ground System - Screen



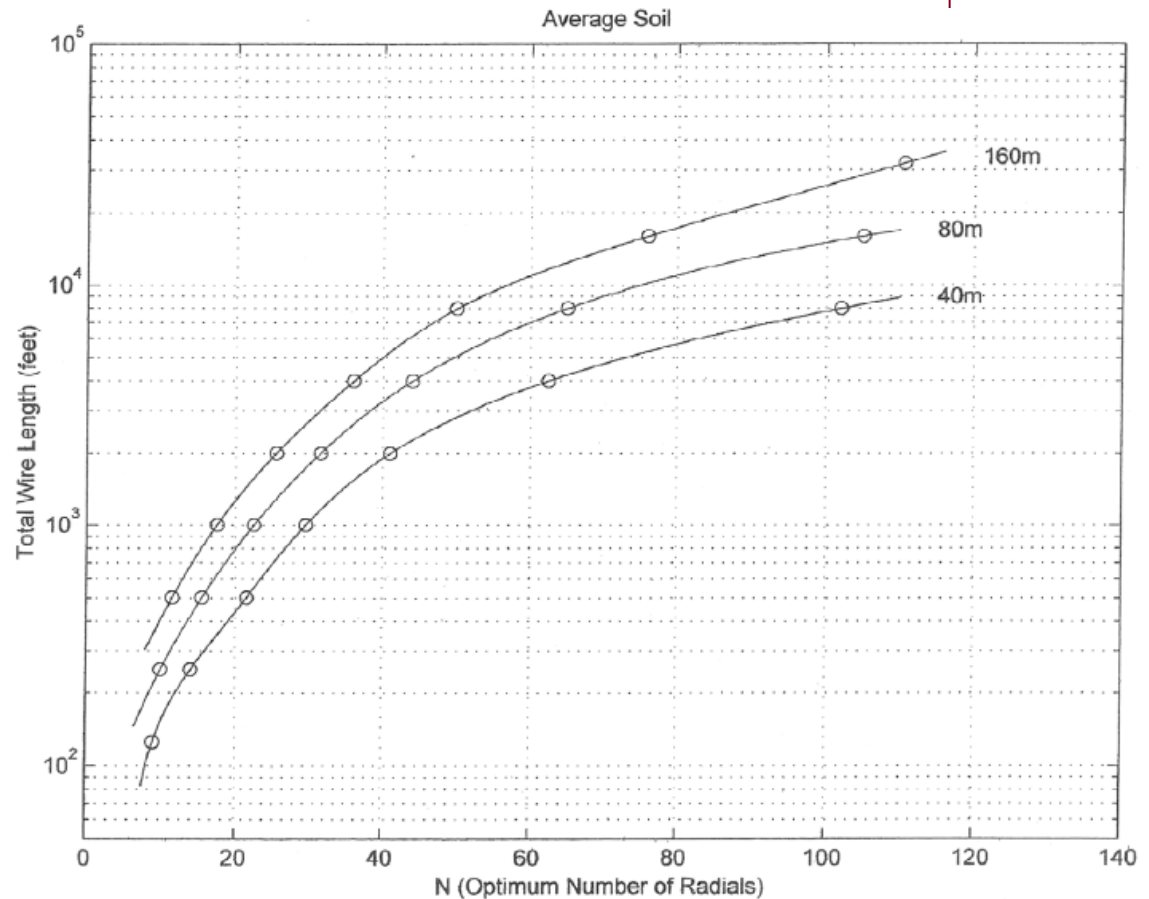
- The Bottom Line

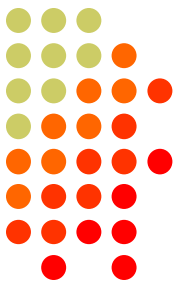


Ground System - Screen



- K3LC, NCJ
Mar 2004
- Optimum Use
of Available
Wire





Ground System - Screen

- Mesh
 - Galvanized, avoid bare aluminum
 - Fencing, hardware cloth, chicken wire
- Diameter
 - Concentrate on $1/8^{\text{th}}$ wavelength around base
 - Supplement with longer radials
- Elevated Radials



Base-Feeding Towers

- Insulating the base
 - Three-leg or pier
 - Types of insulators
 - Spark gaps
- Decide *before* putting up the tower!



WBØW.com



Homemade



Base-Feeding Towers

- Loading effects of guys
 - Suggest insulator close to tower
- Cables and feed lines
 - Run *inside* the tower
 - Bond shields at top and bottom
 - Bring out at ground level



Base-Feeding Towers

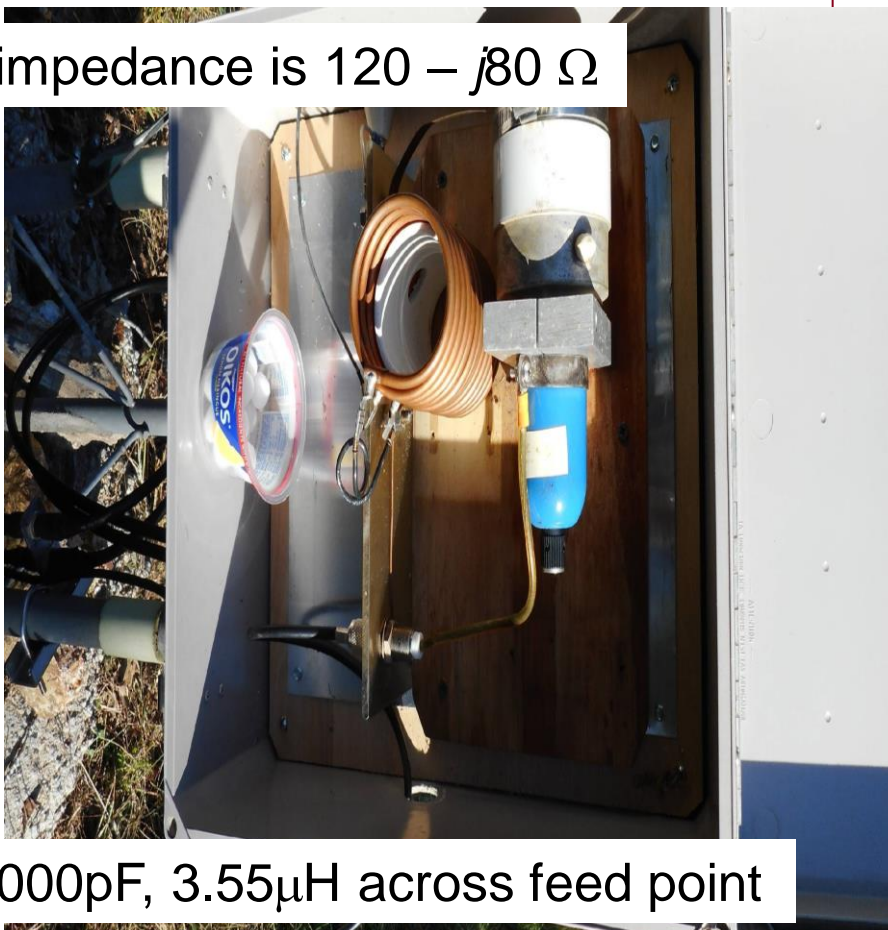
- L-network or series-C
- Determine base impedance with analyzer
 - $Z = R + jX$
- Use online calculator to design L-network
 - Z close to 50Ω allows best bandwidth
- Lengthen or load tower for R close to 50Ω
 - Allows simple series-C match



Base-Feeding Towers



80m feed point impedance is $120 - j80 \Omega$

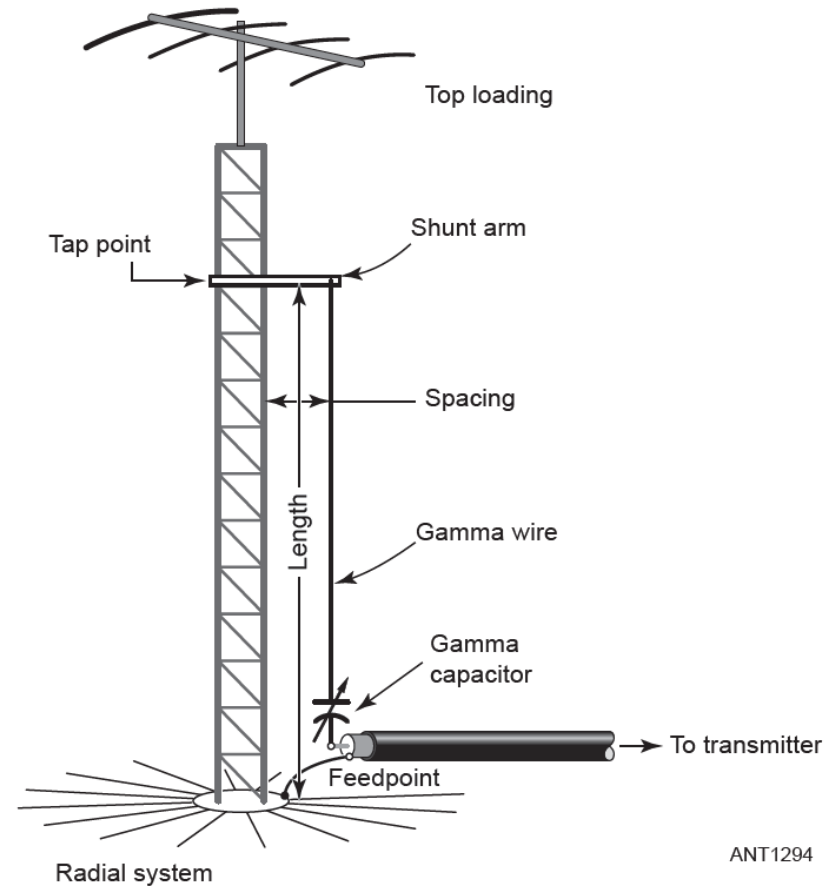


80m network is series 1000pF, 3.55 μ H across feed point

Shunt-Feeding Towers



- Base is grounded
- See new material in *ARRL Antenna Book*
 - Chap 11 – Gen'l Purpose MF/HF Antennas
- Cables and feed lines go *inside* the tower in shunt-feed portion



ANT1294



Shunt-Feeding Towers

- Designing the gamma match
 - Model base impedance, use N6MW calculator
 - Charts from ON4UN *Low-Band DXing*
 - Empirical
 - Try a convenient shunt-arm length
 - Attach at top, measure feed point impedance
 - Move shunt-arm length and position
 - Experiment to find impedance closest to 50Ω



Shunt-Feeding Towers

- Adjusting the shunt-arm and gamma-wire
 - Moving shunt-arm up increases R
 - Increasing gamma-wire spacing
 - Increases R and decreases X_L
- Adjust C to cancel X_L
- Increasing gamma-wire diameter increases SWR bandwidth
- Omega match if $R < 50 \Omega$

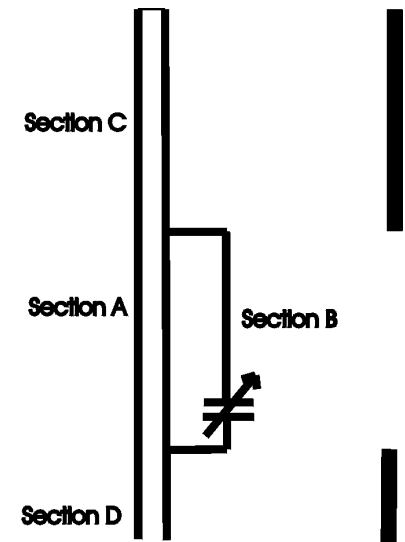


Detuning Towers

- Why is detuning necessary?
- Interaction
 - Affects impedance of other antennas
 - Distorts antenna patterns
 - Couples noise into receive antennas
 - Conducts more RF into the ground

Detuning Towers

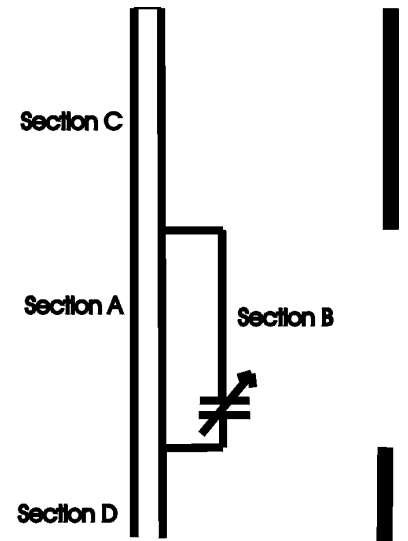
- Creates a “trap” in middle of tower
- Loop of tower plus arms and vertical wire
- Adjustable capacitor at the bottom
- Heavy-duty components and connections – carry full QRO
- May create other resonances in the tower



From w8ji.com

Detuning Towers

- Tune for maximum current in the loop – can be substantial
- Adjust from *below* the loop
- Don't touch the loop while tuning
- All cables must run inside the tower, bonded above and below the trap





Resources

- General Antenna Design Resources
 - ON4UN Low-Band DXing
 - ARRL Antenna Book
- Matching Network Design
 - home.sandiego.edu/~ekim/e194rfs01/jwmatcher/matcher2.html (16 different networks)
- Inductor Design Calculator
 - k7mem.com/Ind_Coil_Ind_Calc.html (Use calculator #2 for large diameter wire)



Resources

- Ground Systems
 - *ARRL Antenna Book* – Chapter 3 “Effects of Ground”
 - Rudy Severns, N6LF: www.antennasbyn6lf.com/
 - Lots of antenna design material
 - Tom Rauch, W8JI: w8ji.com/Antenna%20grounds.htm
 - *Grounding and Bonding for the Radio Amateur*, 2nd edition



Resources

- Shunt-feed design
 - *ARRL Antenna Book* – Chap 11.2.5 “Shunt-Feeding Towers”
 - *ON4UN Low-Band DXing*
 - *GAMMAMW9a* spreadsheet at n6mw.jimdofree.com/antenna-matching
 - “How to Shunt-Feed Your Tower” by VE6WZ [youtube.com/watch?v=cHlc5MTGTfM&ab_channel=ve6wz](https://www.youtube.com/watch?v=cHlc5MTGTfM&ab_channel=ve6wz)



Detuning Towers

- Tom Rauch, W8JI:
w8ji.com/detuning_towers.htm
- Ron Schwartz, VE3VN:
ve3vn.blogspot.com/2014/03/detuning-tower-from-vertically.html
 - Lots of modeling information
- “How To Detune a Tower” by WXØB
ncjweb.com/bonus-content/novdec05feat.pdf



THANK YOU!

QUESTIONS?