



2007 Hamfest Seminar

Getting on the Air And Antennas

This presentation will be available on FRRL web site www.fril.org

Starting February 23, 2007



More Privileges...

More Fun...



February 23 was a new beginning...

- No more CW testing
- CW is now just like all other non-voice modes
 - Optional but challenging and fun
- All Technicians now have Novice privileges
- Any license is a progressively more difficult written test
- No CW rule is on top of other December 15 rule Changes
 - General: Larger 75m,40m,15m Phone Bands
 - Advanced: Larger 75m and 40m Phone Bands
 - Extra: Larger 75m and 40m Phone Bands
 - Kenwood Sky Command legal with 2m auxiliary control
 - ...



CW is not going away soon

- Still good and useful
 - Low power operation possible
 - Simple low cost transmitter
 - Very spectrum efficient
 - Fun “secret” language for kids
 - 73% of hams know it to some extent
 - DX stations use it a lot

ARRL Top Ten Reasons to Try Morse Code

1. It's a new way to communicate
2. Age is no barrier
3. It's a minimalist mode
4. You'll know something most people don't
5. It's like text messaging without the monthly bill
6. More makes you use your head
7. CW has a low profile
8. There's no language barrier with Morse Code
9. It's a great way to work distant stations
10. You've already got CW privileges

What can I do with Technician License?

- Previous Rules

 - Full power and all modes above 50 MHz

- New Rules

 - 28.3-28.5 MHz: Voice 200W

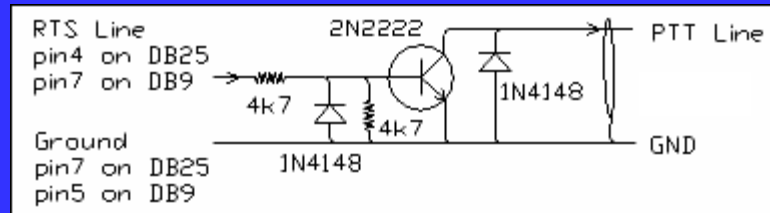
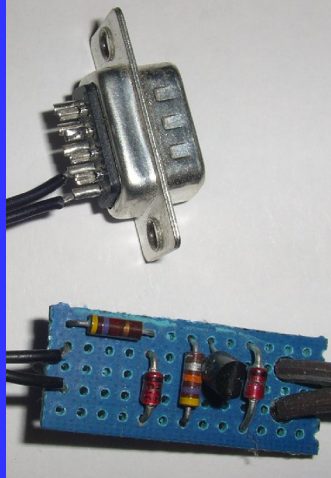
 - 28.0-28.3 MHz: Any non-voice mode 200W

 - 3.525-3.6 MHz: CW only 200W

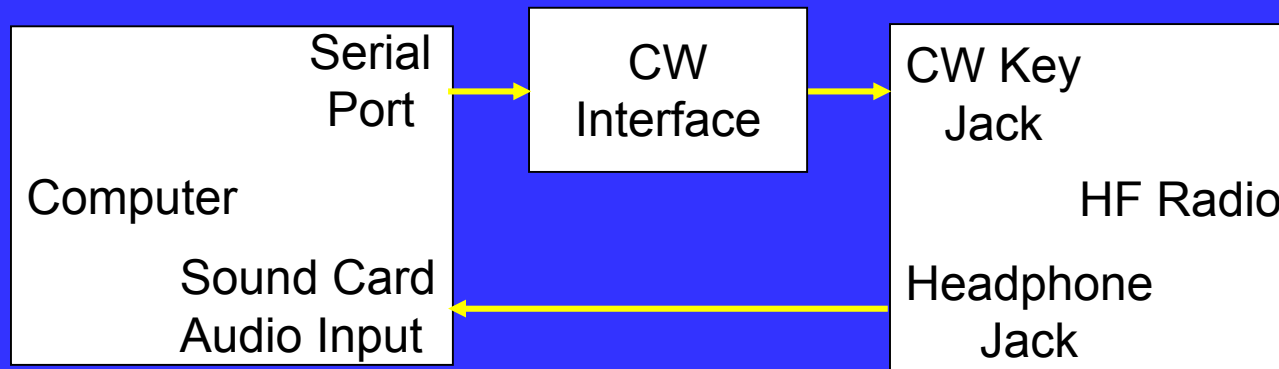
 - 7.025-7.125 MHz: CW only 200W

 - 21.025-21.2 MHz: CW only 200W

Physical Setup for Computer CW



Antenna



Transmit and Receive
Software

CWGET \$41 (+CWTYPE \$0)

MixW (\$50)

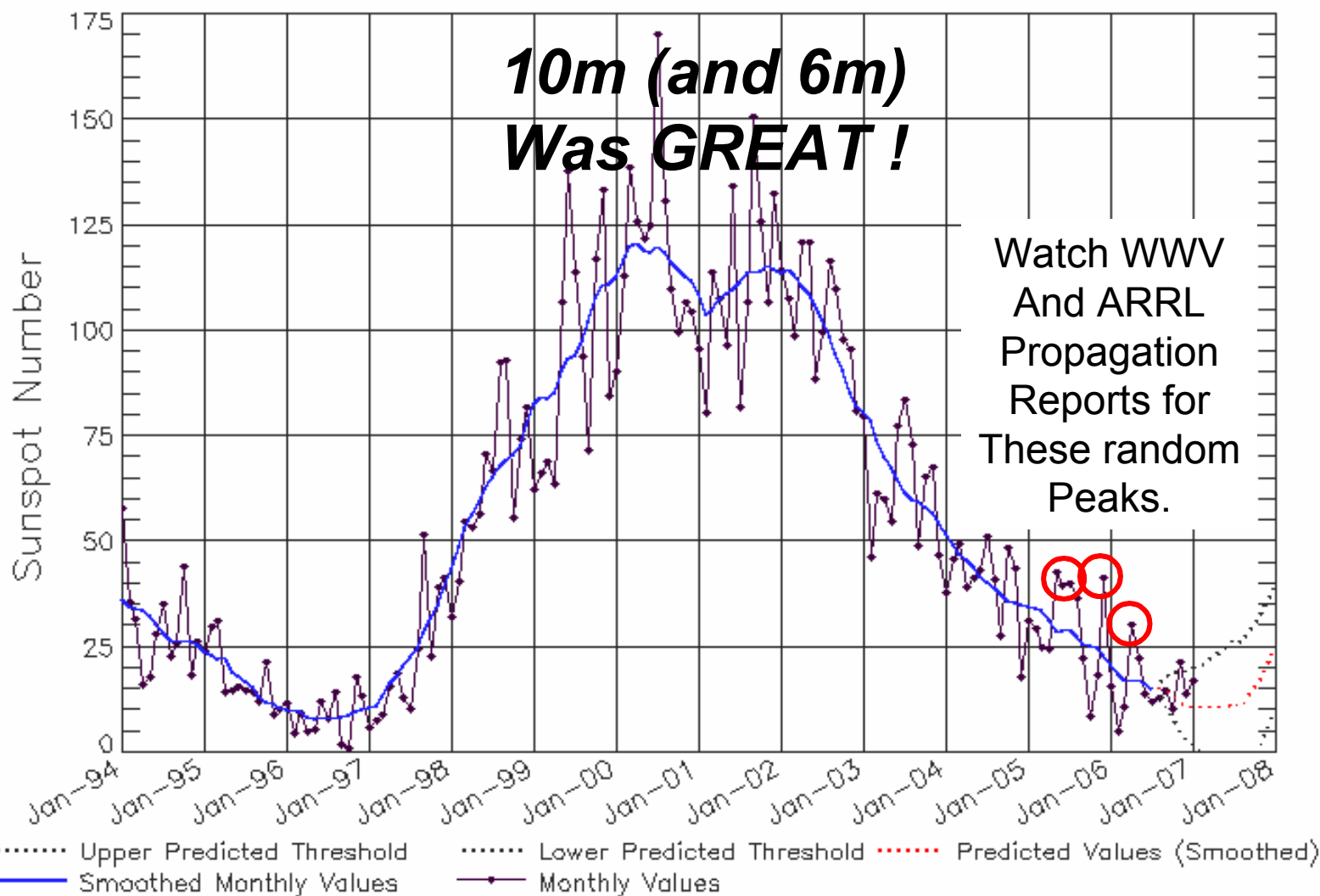
Multi-PSK(\$40)

Technicians above 50 MHz

- Anytime
 - FM Repeaters and Simplex
 - APRS and Packet
 - Satellites
 - Greater distance using SSB and CW
 - Meteor scatter and other tropo scatter modes
 - Public service and weather spotting
- For the next few years (low sun spots)
 - Hope for Sporadic E openings on 6m
- Several years from now (higher sun spots)
 - DX openings on 6m with F layer

Present Solar Cycle

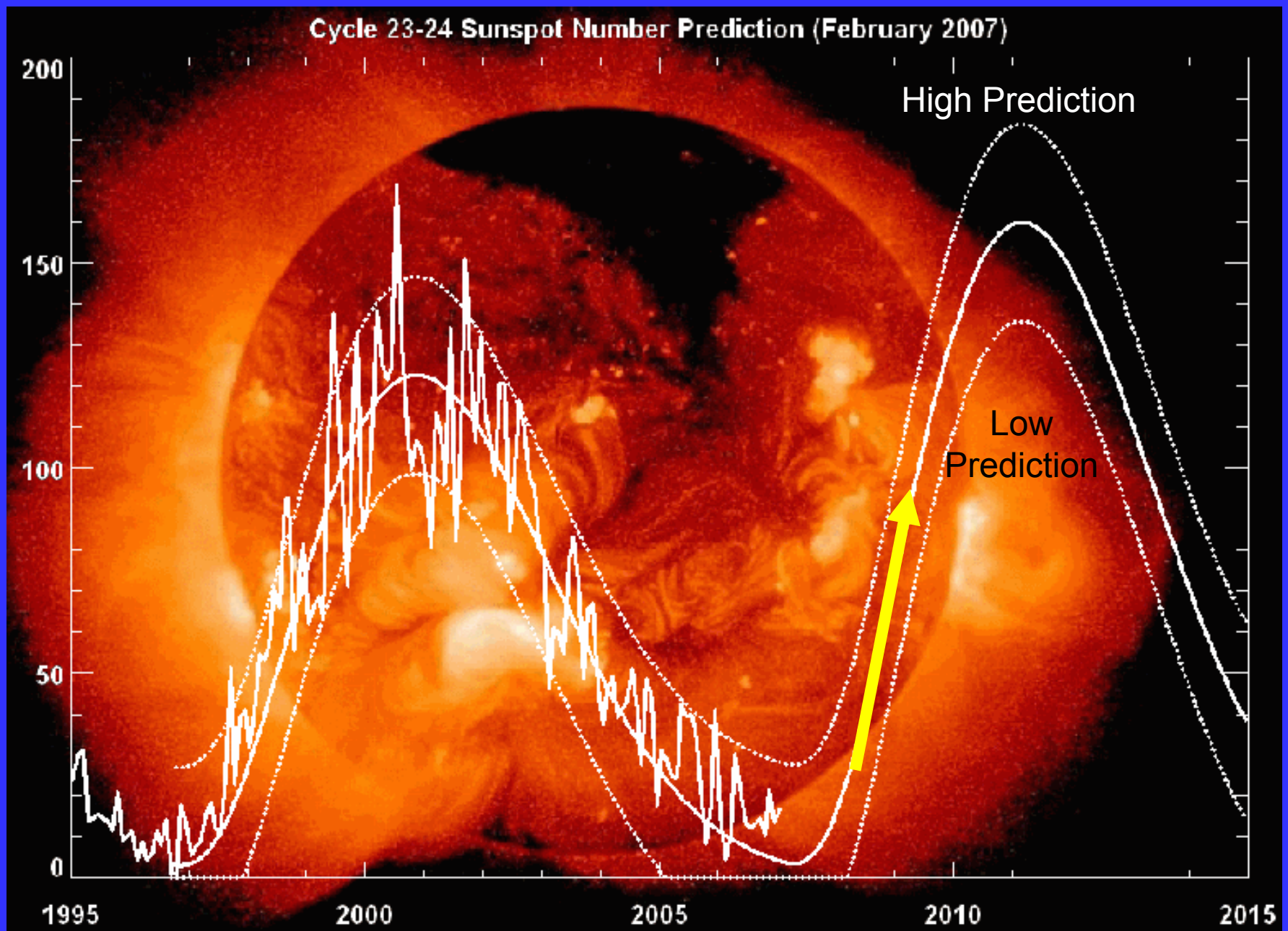
ISES Solar Cycle Sunspot Number Progression
Data Through 31 Jan 07



Updated 2007 Feb 1

NOAA/SEC Boulder, CO USA

In about 2 years, LOOK OUT !



When do I use which band?

It depends on how far or close you want to talk?

Summer vs Winter differences

Daytime vs Nighttime differences

Summer Daytime

Noisy 160,80m
Midwest+ 40m
Whole US and DX 20m
Spotty Far US and DX 17m
Some DX 15m
Rare DX 10m

Summer Nighttime

High noise on 160,80m some on 40m
Some DX on 20m early evening
17-10m Ground Wave local QSO

Today's Low Sun Spots

Winter Daytime

Quiet Midwest 160,80m
Quiet Midwest+ 40m
Whole US and DX 20m
Far US and some DX 17m
Some DX 15m
Rare DX 10m

Winter Nighttime

DX and low noise on 160,80,40m
Some closer QSO on 160,80m
DX on 60m limited by few allocations
40m Foreign Broadcast 7.1-7.3
20m-10m Ground Wave local QSO

Where are all these callsigns from?

A standard country prefix list is not enough!

You should also refer to an
ITU Callsign Allocation List

Especially true during contests, trying to attract you to work them.
There are even CQ Prefix Contests where prefixes are multipliers

This is a partial ITU list go to
<http://www.arrl.org/awards/dxcc/itucalls.html>

AAA-ALZ United States of America	ESA-ESZ Estonia (Republic of)	J3A-J3Z Grenada
AMA-AOZ Spain	ETA-ETZ Ethiopia (Federal Democratic Republic of)	J4A-J4Z Greece
APA-ASZ Pakistan (Islamic Republic of)	EUA-EWZ Belarus (Republic of)	J5A-J5Z Guinea-Bissau (Republic of)
ATA-AWZ India (Republic of)	EXA-EXZ Kyrgyz Republic	J6A-J6Z Saint Lucia
AXA-AXZ Australia	EYA-EYZ Tajikistan (Republic of)	J7A-J7Z Dominica (Commonwealth of)
AYA-AZZ Argentine Republic	EZA-EZZ Turkmenistan	J8A-J8Z Saint Vincent and the Grenadines
A2A-A2Z Botswana (Republic of)	E2A-E2Z Thailand	KAA-KZZ United States of America
A3A-A3Z Tonga (Kingdom of)	E3A-E3Z Eritrea	LAA-LNZ Norway
A4A-A4Z Oman (Sultanate of)	E4A-E4Z Palestinian Authority	LOA-LWZ Argentine Republic
A5A-A5Z Bhutan (Kingdom of)	E5A-E5Z New Zealand - Cook Islands	LXA-LXZ Luxembourg
A6A-A6Z United Arab Emirates	FAA-FZZ France	LYA-LYZ Lithuania (Republic of)
A7A-A7Z Qatar (State of)	GAA-GZZ Great Britain and Northern Ireland	LZA-LZZ Bulgaria (Republic of)
A8A-A8Z Liberia (Republic of)	HAA-HAZ Hungary (Republic of)	L2A-L9Z Argentine Republic
A9A-A9Z Bahrain (State of)	HBA-HBZ Switzerland (Confederation of)	MAA-MZZ Great Britain and Northern Ireland
BAA-BZZ China (People's Republic of)	HCA-HDZ Ecuador	NAA-NZZ United States of America
CAA-CEZ Chile CFA-CKZ Canada	HEA-HEZ Switzerland (Confederation of)	OAA-OCZ Peru
CLA-CMZ Cuba	HFA-HFZ Poland (Republic of)	ODA-ODZ Lebanon
CNA-CNZ Morocco (Kingdom of)	HGA-HGZ Hungary (Republic of)	OEA-OEZ Austria
COA-COZ Cuba	HHA-HHZ Haiti (Republic of)	OFA-OJZ Finland
CPA-CPZ Bolivia (Republic of)	HIA-HIZ Dominican Republic	OKA-OLZ Czech Republic
CQA-CUZ Portugal	HJA-HKZ Colombia (Republic of)	OMA-OMZ Slovak Republic
CVA-CXZ Uruguay (Eastern Republic of)	HLA-HLZ Korea (Republic of)	ONA-OTZ Belgium
CYA-CZZ Canada	HMA-HMZ Korea (Democratic People's Republic of)	OUA-OZZ Denmark
C2A-C2Z Nauru (Republic of)	HNA-HNZ Iraq (Republic of)	PAA-PIZ Netherlands (Kingdom of the)
C3A-C3Z Andorra (Principality of)	HOA-HPZ Panama (Republic of)	PJA-PJZ Netherlands Antilles
C4A-C4Z Cyprus (Republic of)	HQA-HRZ Honduras (Republic of)	PKA-POZ Indonesia (Republic of)
C5A-C5Z Gambia (Republic of the)	HSA-HSZ Thailand	PPA-PYZ Brazil (Federative Republic of)
C6A-C6Z Bahamas (Commonwealth of the)	HTA-HTZ Nicaragua	PZA-PZZ Suriname (Republic of)
C7A-C7Z World Meteorological Organization	HUA-HUZ El Salvador (Republic of)	P2A-P2Z Papua New Guinea
C8A-C9Z Mozambique (Republic of)	HVA-HVZ Vatican City State	P3A-P3Z Cyprus (Republic of)
DAA-DRZ Germany (Federal Republic of)	HWA-HYZ France	P4A-P4Z Netherlands (Kingdom of the) - Aruba
DSA-DTZ Korea (Republic of)	HZA-HZZ Saudi Arabia (Kingdom of)	P5A-P9Z Korea (Democratic People's Republic of)
DUA-DZZ Philippines (Republic of the)	H2A-H2Z Cyprus (Republic of)	RAA-RZZ Russian Federation
D2A-D3Z Angola (Republic of)	H3A-H3Z Panama (Republic of)	SAA-SMZ Sweden
D4A-D4Z Cape Verde (Republic of)	H4A-H4Z Solomon Islands	SNA-SRZ Poland (Republic of)
D5A-D5Z Liberia (Republic of)	H6A-H7Z Nicaragua	SSA-SSM Egypt (Arab Republic of)
D6A-D6Z Comoros (Islamic Federal Republic of the)	H8A-H9Z Panama (Republic of)	SSN-STZ Sudan (Republic of the)
D7A-D9Z Korea (Republic of)	IAA-IZZ Italy	SUA-SUZ Egypt (Arab Republic of)
EAA-EHZ Spain EIA-EJZ Ireland	JAA-JSZ Japan	SVA-SZZ Greece
EKA-EKZ Armenia (Republic of)	JTA-JVZ Mongolia	S2A-S3Z Bangladesh (People's Republic of)
ELA-ELZ Liberia (Republic of)	JWA-JXZ Norway	S5A-S5Z Slovenia (Republic of)
EMA-EOZ Ukraine	JYA-JYZ Jordan (Hashemite Kingdom of)	S6A-S6Z Singapore (Republic of)
EPA-EQZ Iran (Islamic Republic of)	JZA-JZZ Indonesia (Republic of)	S7A-S7Z Seychelles (Republic of)
ERA-ERZ Moldova (Republic of)	J2A-J2Z Djibouti (Republic of)	S8A-S8Z South Africa (Republic of)
		S9A-S9Z Sao Tome and Principe

Nets, Nets, Nets

- Public Service and Mobile...
- Message Traffic...
- Maritime, Safety, Hurricane...
- Ragchew and Roundtable...
- RV and Motorhomes...
- QRP...
- DX...
- YL...
- Regional and ARRL Section...
- Worked All States, Worked All Counties...
- Collins, Heathkit, Swan, Icom...
- Special Interest...

- ARRL Net Search
- <http://www.arrl.org/FandES/field/nets/client/index.html>

Contests, Contests, Contests...

- ARRL Contests
- CQ WAZ Contests
- State QSO Parties
- PSK Contests
- RTTY Contests

The best way to quickly work DX

The best way to quickly verify your station performance

Contests just about every weekend...

Chasing Paper... (Not the Newspaper)

- QSL cards – for fun, stamps, and awards
 - Legacy Postcard – Direct or via Bureaus, IRC
 - eQSL
 - LOTW – ARRL Logbook of the World
- Awards
 - WAS, WAC, DXCC, VUCC, IOTA, Counties...
 - WAZ, WPX...
- Special Events
 - Route 66, Battleships, Lighthouses...
 - Check out listing in QST each month

When in doubt, just get on the air...

- Listen to a band to hear activity
- Find someone calling CQ and answer them
or
- Find an empty place on the band
- Listen for a minute or so
- Ask if the frequency is in use a couple of times
- Call CQ “3 by 2” listen and repeat CQ “3 by 2”
- “3 by 2” is “CQ CQ CQ this is AH6EZ AH6EZ”
- The idea is to attract casual listeners to your CQ and to repeat your call sign. Making your CQ short with time to listen will increase your success. If you make a “10 by 10” CQ listeners will get bored and move on.
- ***Experience the magic of radio...***

How do I get on the air?

- A radio
 - The easy part ranging from free to \$1500+
- An antenna
 - Learn different configurations
 - Find a place to put it
 - Make it efficient
 - Make it spouse/neighbor/association approved
- Listening and then communicating

Antenna Solutions

Antennas are all about tradeoffs

- Cheap vs Expensive ?
- Huge and Tall vs Small and Unobtrusive ?
- Efficient vs Inefficient ?
- Multiband vs Single band ?
- Robust and long-lasting vs Weak and short-lived ?
- Local QSOs vs DX ?
- Single support, Multiple, or Ground Mounted ?
- Low or high power handling ?
- Resonant or non-resonant ?
- Self constructed, gradual learning by doing vs proven commercial

Constrained by your environment

- Indoor or outdoor ?
- Small or large lot ?
- Proximity to power lines ?
- Attic space ?
- Sturdy trees ?
- Chimney or roof tripod ?
- Attic, upper floor, or basement shack ?
- Yard space for radials ?
- Spouse friendly ?
- Neighbor friendly ?
- Deed or covenant restrictions ?

Trees – Friends or Foes

- If tall and sturdy, they make great supports for wire antennas. Remember counter weights
- Trees can also be in the wrong places
 - Get in the way of rotatable antennas
 - Too close together or not far enough away

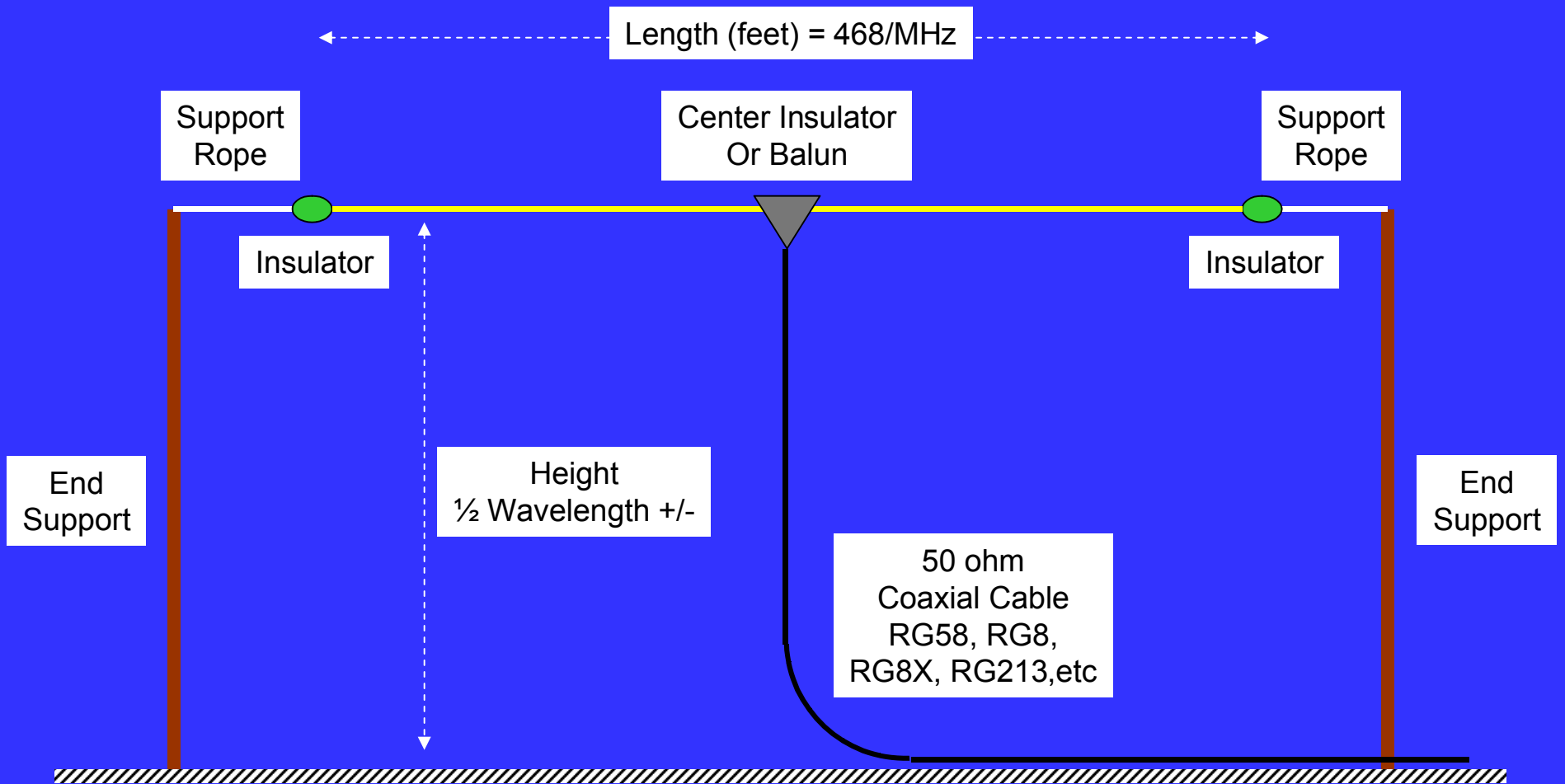
Antenna Factors to Consider

- Radiating efficiency
- Durability
- Cost
- Grounding
- Take off angle
- Antenna lobes
- RF Bandwidth
- Shack location and transmission line entry
- RF interference to self and neighbors
- Power line and other man made noise
- Visibility to spouse and neighbors
- Electromagnetic Safety
- Spacing from objects, power lines if it falls down

HF Antennas are all about geometry

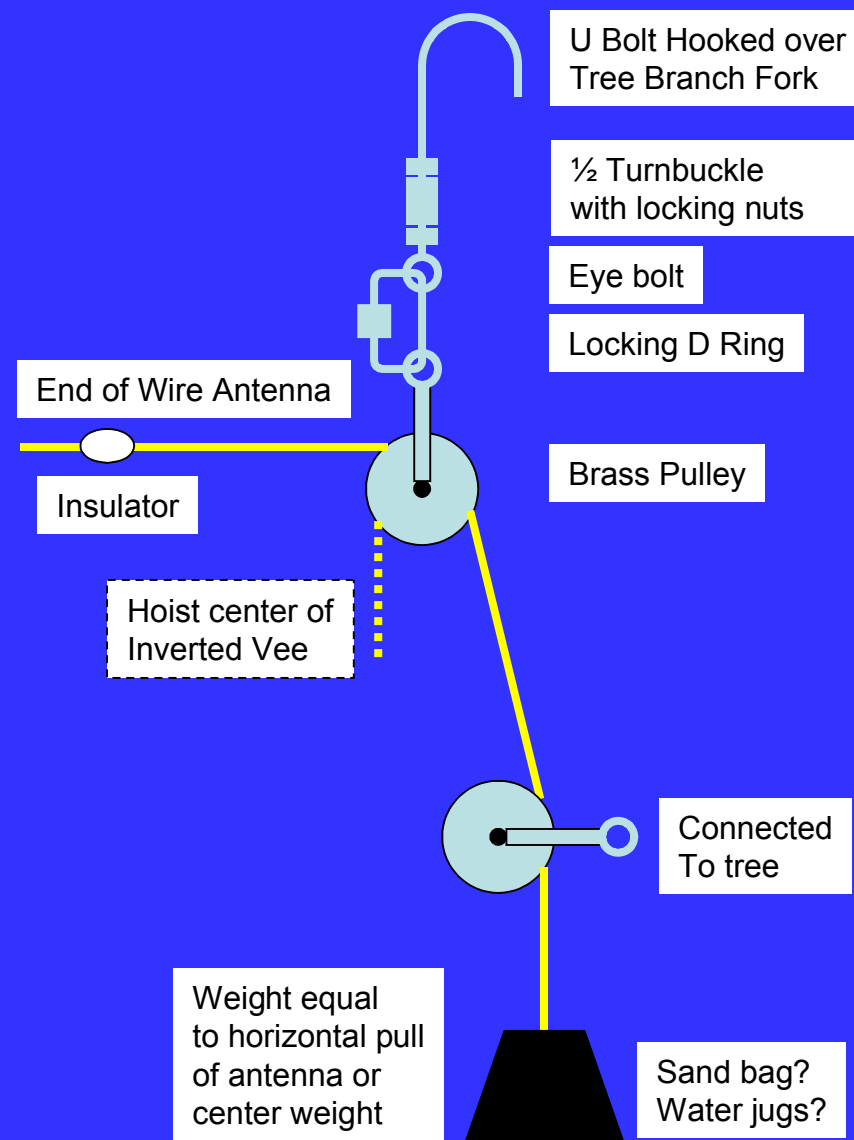
- Higher and longer better than low and short
- Two supports generally mean a dipole
- One support generally means inverted vee
- No support generally means vertical
- A tower can provide rotatable antennas with gain on transmit and receive
- Attic space generally dipole but could be low noise receive horizontal loop

Basic Dipole

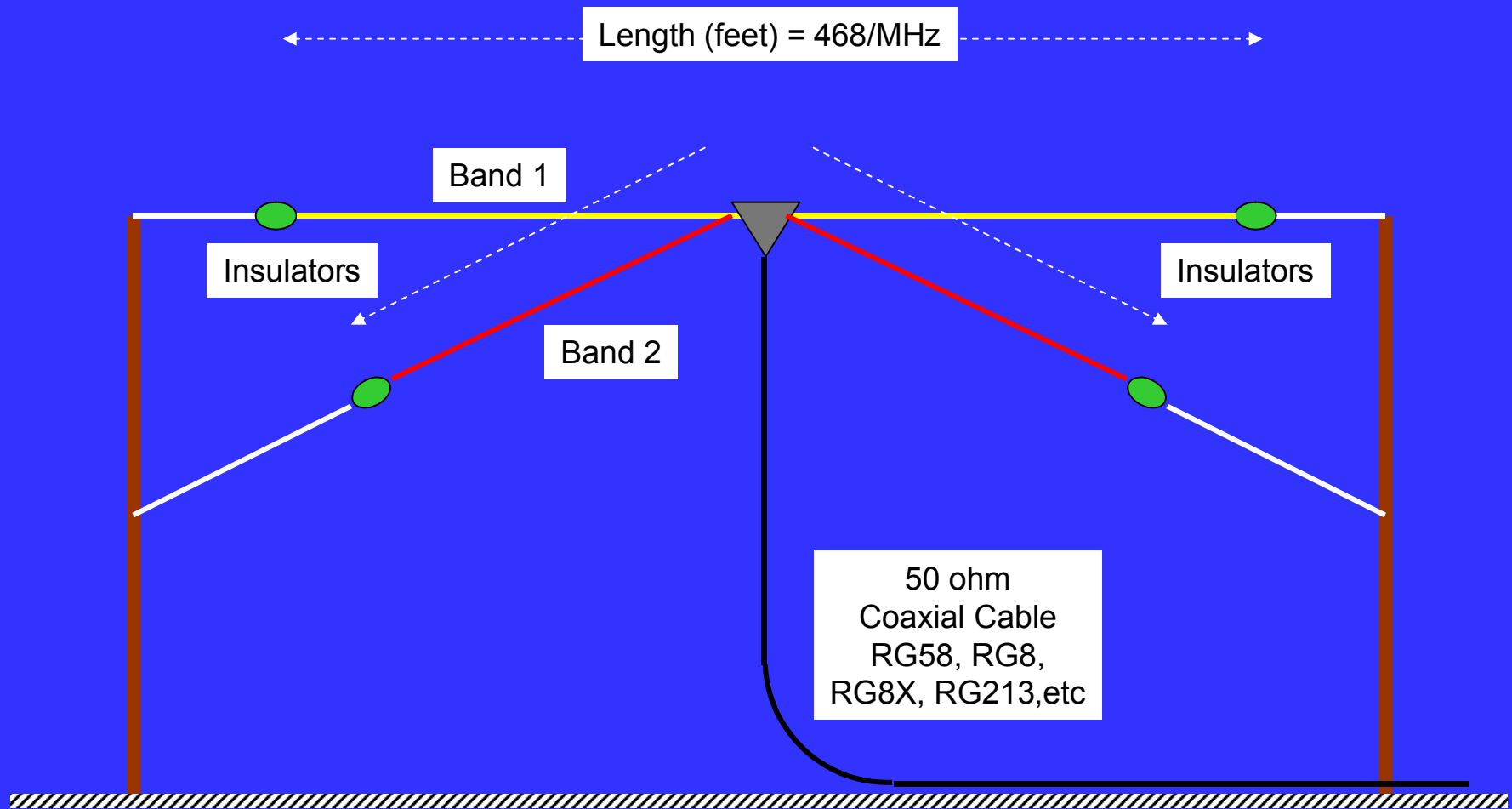


Recommendations for Counter Weighting

- Use a fixed pulley to hoist the end/middle of a wire antenna
- Keep tension on wire antenna while allowing wind to move the trees (and move weight up and down)
- Paint everything flat color to match surroundings



Multiband Dipole



More efficient at radiating transmitter harmonics, some length interaction between bands

Inverted Vee

Length (feet) = longer than $449/\text{MHz}$ (3-5% shorter than a dipole)

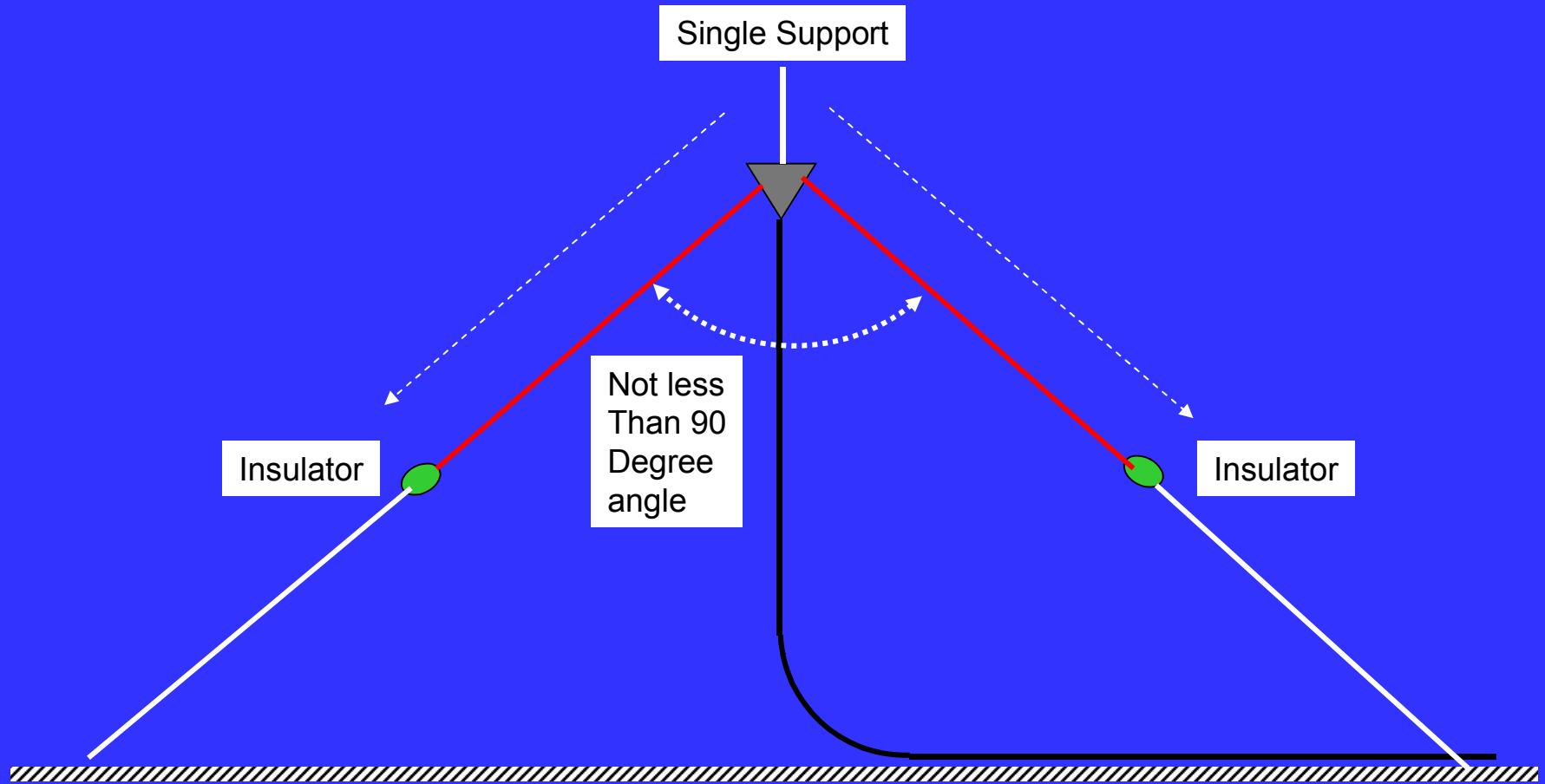
Single Support

Insulator

Insulator

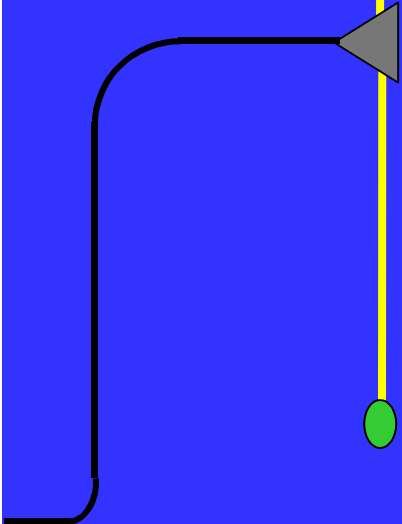
Not less
Than 90
Degree
angle

Tied to ground, fence, shed, weak tree, etc.



Vertical Antennas

Half wave
Vertical
Dipole

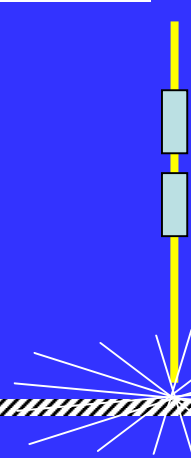


No
Ground
Inefficiencies

Adding
Traps
For Multiband
Reduce
Efficiency

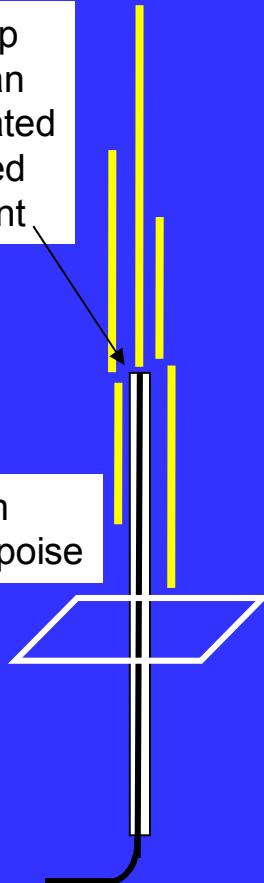


Ground rod
inefficient



The more radials
the better for
radiation efficiency

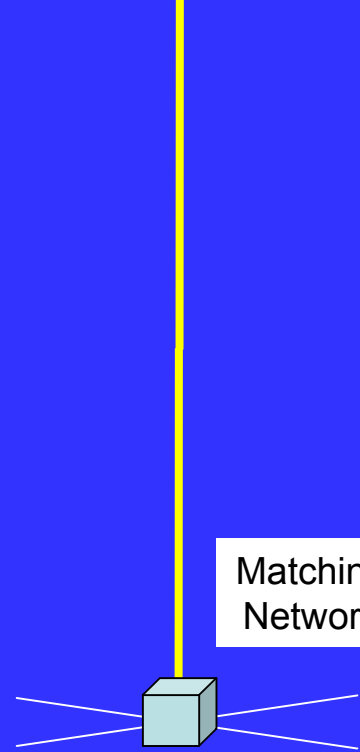
Gap
Titan
Elevated
Feed
Point



40m
Counterpoise

No
Ground
Radials

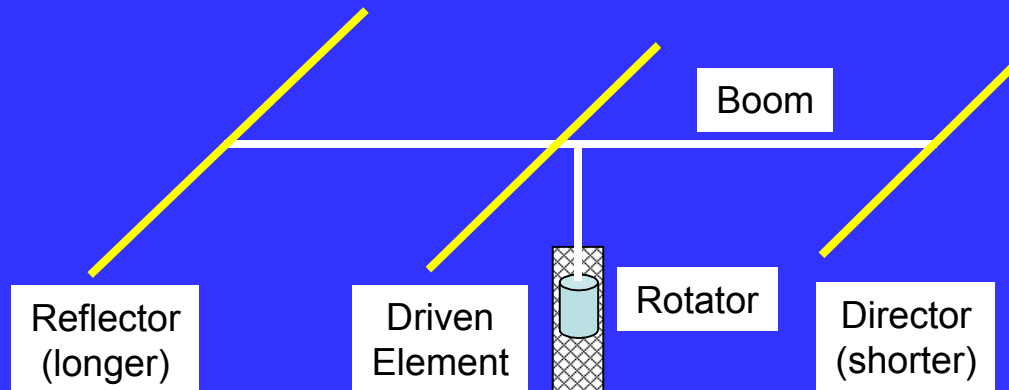
R7000
Halfwave



Matching
Network

No
Ground
Radials

Beams or Yagis



Lots of issues

- Self supported or guyed ?
- Space for guy wires ?
- Foundation sizing, house bracket ?
- Crank up, tilt over ?
- Tree clearance ?
- Wind loading ?
- Gain, front to back ?
- Multiple bands ?

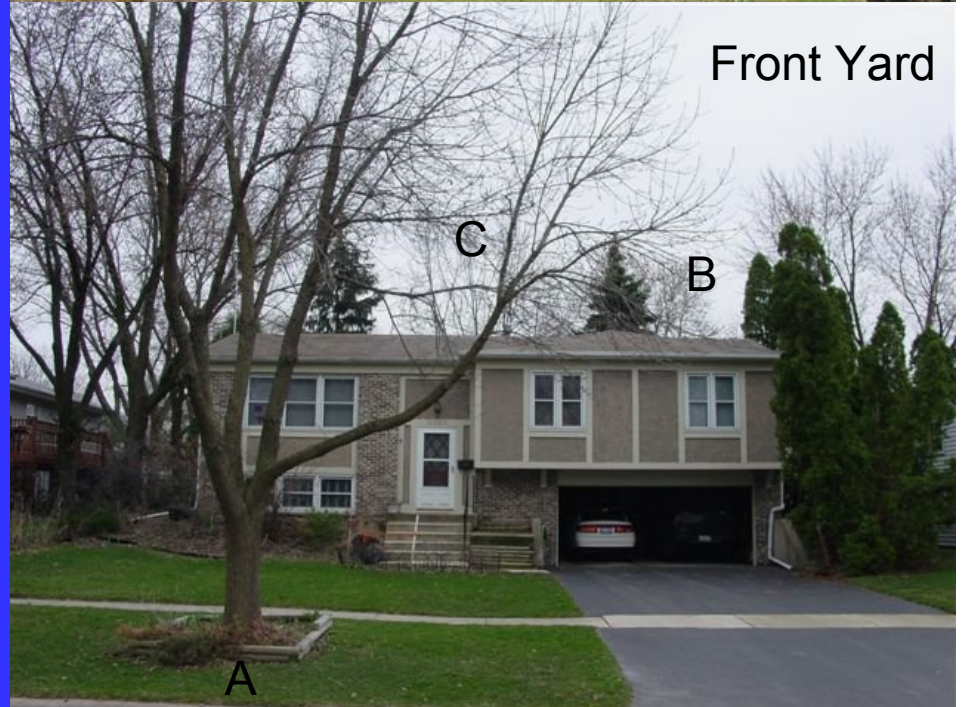
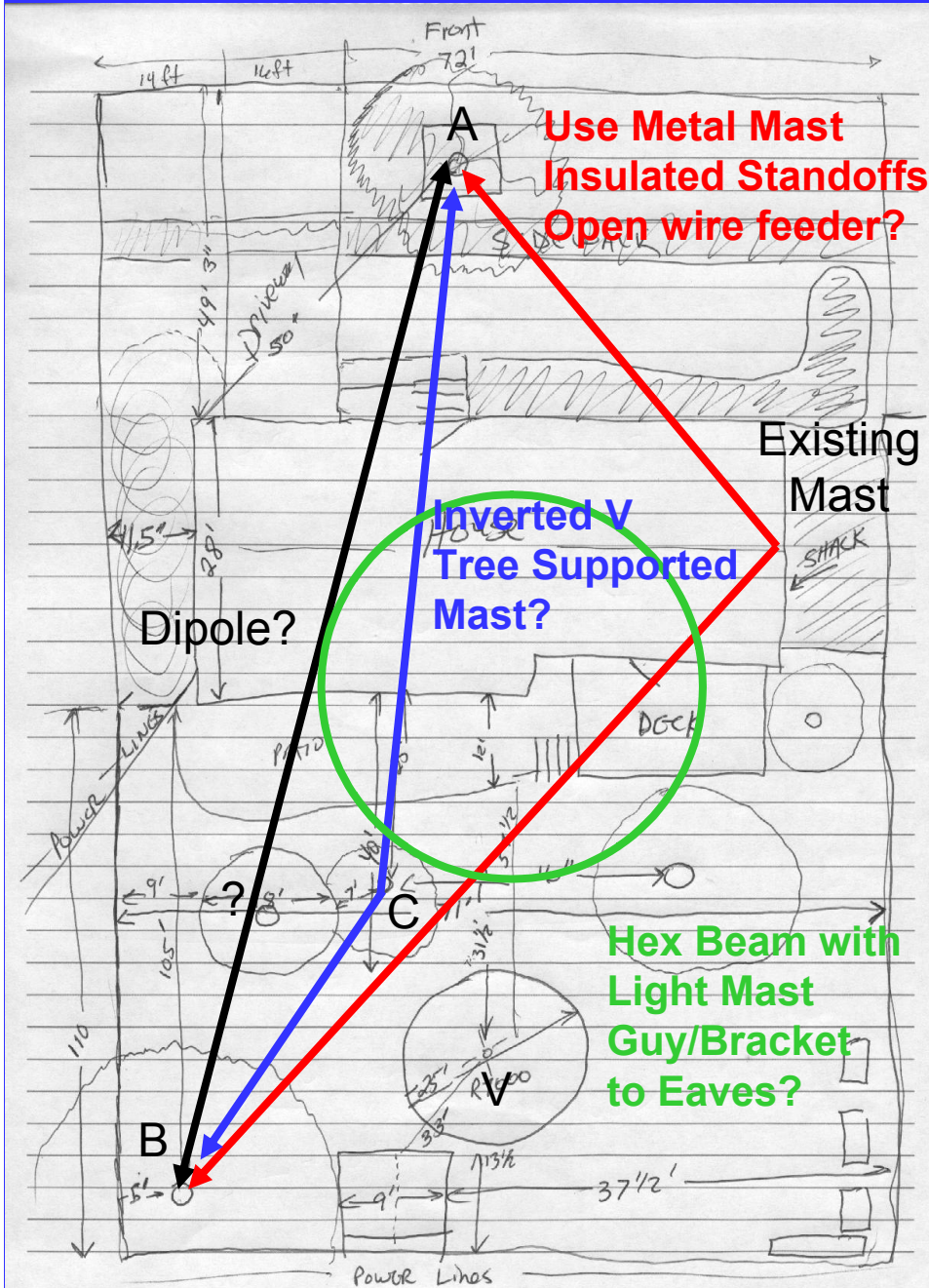
A tower done right
Is not a trivial task

Civil Engineering
Of Foundation ?

Some Golden Rules

- If it is a piece of metal, it is an antenna
- In general, the longer and higher the better
- Don't forget low noise receive antennas

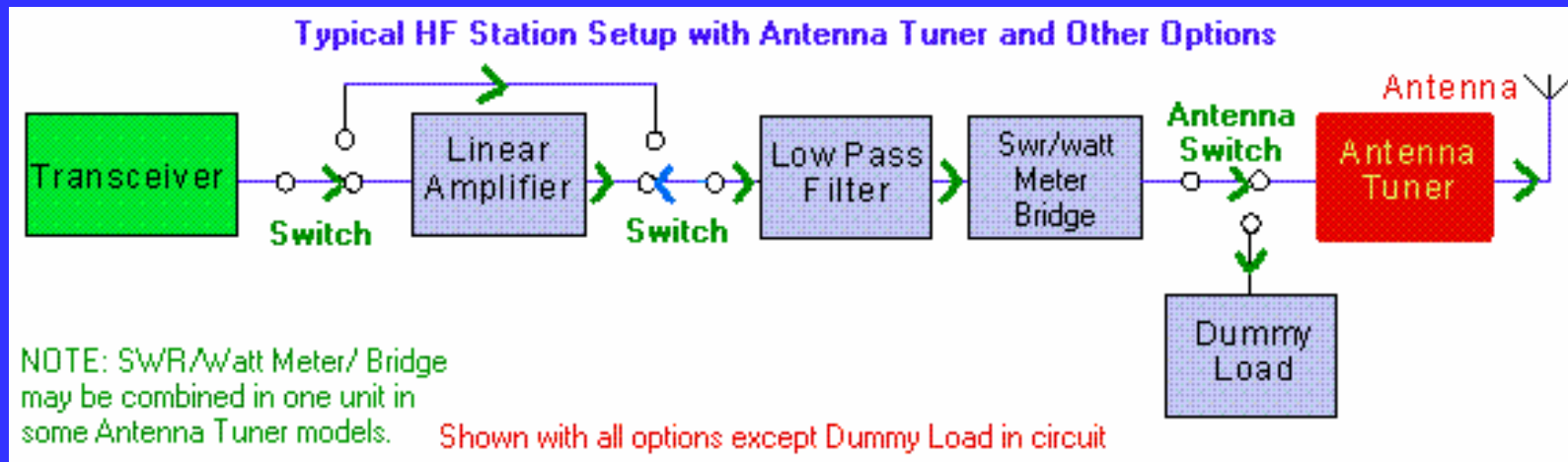
Suburban QTH planning



How to get on the air...

You put up an antenna... now what?

- How do SWR meters work?
 - Forward and reflected power
 - Forward power is good, reflected power is bad
 - Single meter – needs forward power set
 - Possible to tune for minimum forward and reflected
 - Dual needle – simultaneous forward/reverse power
 - Enables tuning for maximum forward and minimum reflected power
 - Old rigs required external meter, newer rigs have F or Rev or F and R
- Where do you put an SWR meter?
 - Ideally right at the antenna shows the antenna
 - At the rig will show what the rig will see
- Create an SWR curve
 - Will reveal if your antenna is too long or too short
 - Transmit lowest power for full reading
 - Document for future reference
 - Seasonal changes? Degradation?

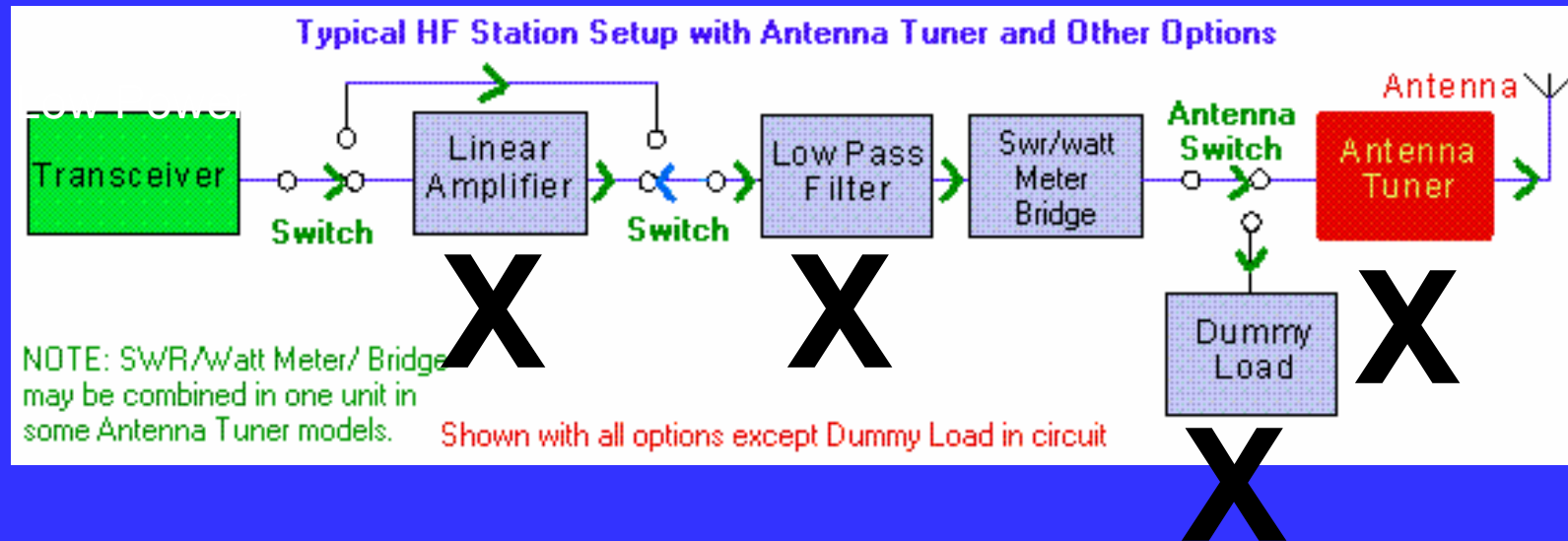


Tune pi-network of Transceiver and Linear Amplifier into dummy load first, tune antenna tuner for best receive signal, and then finally adjust antenna tuner with lowest possible transmitter power on a clear frequency

Unkey your transmitter while turning any switches or coil taps transmitting while adjusting a clean roller coil is ok

Make a log of the antenna tuner knob positions for each band/antenna combination

Making an SWR Curve



If you have an MFJ Antenna Analyzer or Noise Bridge
you do not need to transmit at all

What does minimum SWR mean?

It depends on where you are measuring it

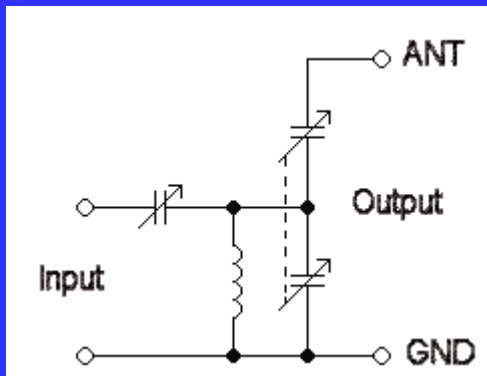
If measured at the transmitter, it means your transmitter will put out maximum power

If measured at the antenna it means no added feedline loss

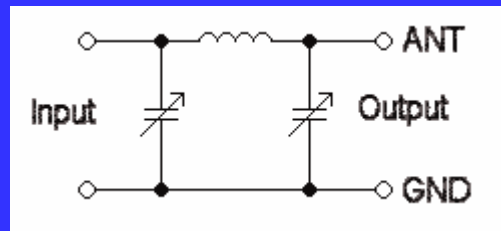
It does not necessarily mean your antenna is efficient or well tuned

It means less heat in the transmitter

Types of Antenna Tuners

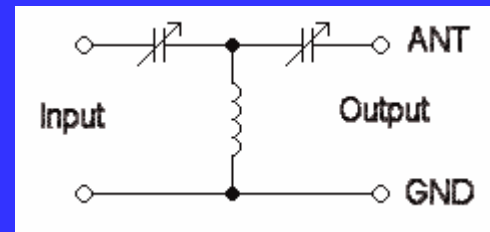


Ultimate Transmatch



Pi-Network

Does not attenuate harmonics

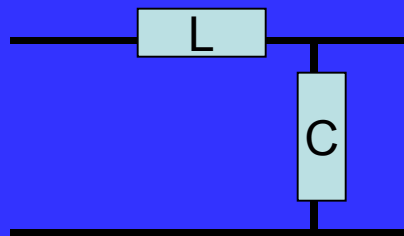


T-Network

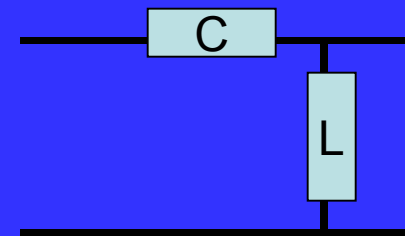
Loss goes up when impedance goes down

Lowest loss is tuning combination with lowest L

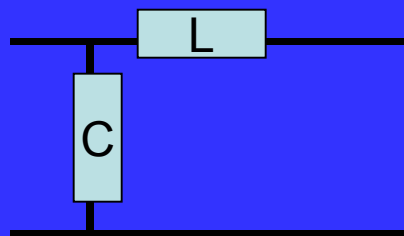
Also High Pass Filter



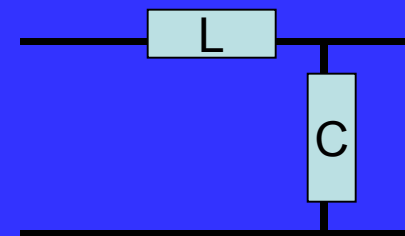
Also Low Pass Filter



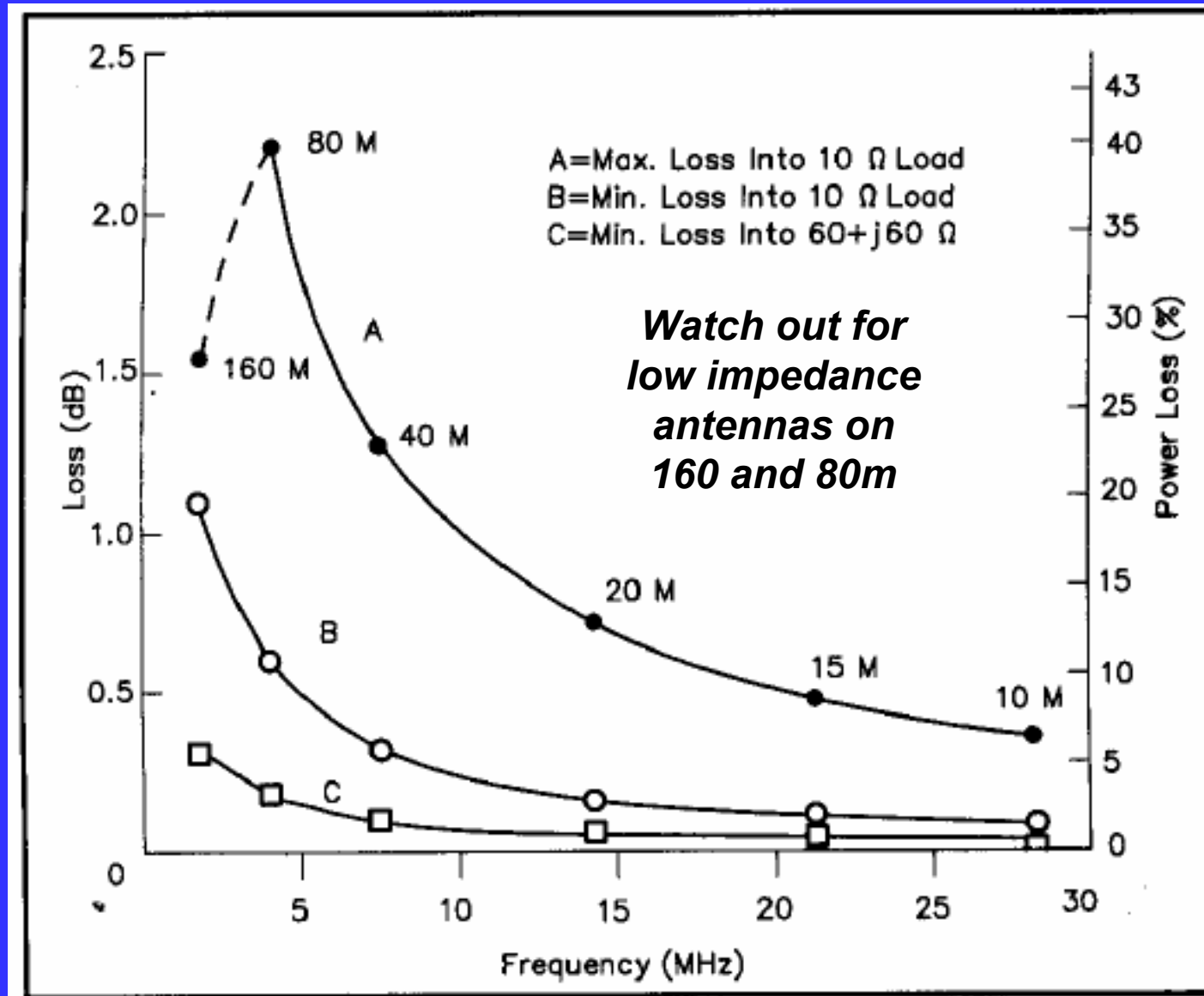
Used for Low Impedance Antennas



Used for High Impedance Antennas



Losses in a T-Network Tuner



Running 100W, 1dB is only 21 W, however running 1KW it is 210 W as HEAT

T-Network Tuner Procedure

- Roller Inductor
 - Set the output capacitor to maximum
 - Set the input capacitor to half
 - Tune the coil for minimum SWR, sharp dip
 - Alternate between input capacitor and coil
 - If you can't reach SWR 1:1, reduce output capacitor somewhat and start again
- Tapped Inductor
 - Set input and output capacitors to half
 - Select coil tap and adjust output capacitor for dip
 - If no dip try different coil tap
 - Coil tap can usually be set by maximizing rx noise
 - When you find a dip with output, then dip the input capacitor
 - Alternate between input and output capacitor
 - There may be solutions with two different coil settings, pick the one with the lowest inductance so that the output capacitor is maximized for lowest loss

Antenna Tuners

- If your antenna is broadband enough and 50 ohms you do not need an antenna tuner
- Automatic tuners inside or outside transceivers are more common these days
 - Having a low SWR at your transmitter may just be covering up a poorly tuned antenna
 - Measure your antenna (lowest tx power) with the tuner bypassed first
- Manual tuners come in many shapes and sizes
 - Switched inductors may limit matching capability
 - Roller inductors can allow fine tuned adjustments
 - Tuners generally have two capacitors and one inductor
 - Tuning controls interact so you need to carefully readjust for the best match
 - Strive for minimum inductance for lowest loss
 - You can make initial tuning adjustment on receive

Your transmitter “likes” your antenna... now what?

- Adjust your transmitter
 - Microphone Gain
 - Speak close to and across the microphone element
 - Make sure microphone is muted or disconnected for digital modes
 - Compression
 - Just enough to see your average modulation increase, ~10dB?
 - No compression for digital modes
 - ALC metering
 - No ALC meter reading for digital modes
 - Mid-range for ragchew, top of ALC range for DX pileup
 - Listen to your own signal
- Remember band edges for YOUR license
- Listen before transmitting
- Ask if a frequency is in use before calling CQ

Transmit audio quality

- Audio quality is affected by signal to noise
- Talk clearly and assertively across the microphone face
- Talk with fairly consistent volume
- Use minimum microphone gain and talk closely to the microphone to maximize your voice and minimize background noises
- Be careful setting the compression, if any
 - Compression is useful for DX because it raises your average transmit power
- Do not modulate over ALC maximum
 - If you are using a digital mode, set levels for NO ALC deflection

Confidence getting on the air

- Try having local QSO to verify good sounding transmit audio
- Monitor your own transmitted signal with headphones
 - Most modern transceivers have a monitor function
 - You can use another receiver, highly attenuated so no overload
- Start by answering CQs and getting honest signal strength reports
 - Most DX stations will just give a 59 signal report for fast QSOs
- Pay attention to band conditions
- Listen around a band before calling CQ
- Call short but frequent CQs, listen
- Be aware that we are at the bottom of the sunspot cycle and band conditions could change quickly

Working DX

- Monitor a DX cluster to quickly learn what DX is on the air and their callsign and frequency
 - Be careful to see who is spotting the DX, are they representative?
- Working a DX pileup is not usually about courtesy, it is about having a stronger signal or having good/lucky timing
- Figure out where the DX station is listening
- Transmit where no one else is transmitting
 - use RIT or dual watch or transmit frequency set function
- Listen to figure out the cadence and style of the DX station
- Will the DX station answer a question such as QSL information or are they working rapid fire signal reports only

Now you know everything...

- Get on the air and have fun
- Talk to new people in distant places
- Share your experiences with others
- Experiment with new modes or different antennas
- Set goals such as WAS or DXCC or QSL cards or just putting pins in a map on the wall of your shack



Thank You
for Attending
this Seminar
at the FRRL Hamfest

Fox River Radio League Information

Web Site: www.frri.org

Meetings: 2nd Tuesdays, 7:30pm Prisco Recreation Center, Route 31 & Illinois, Aurora

Repeaters: 147.21 CTCSS 103.5, 444.3 CTCSS 114.8 (with IRLP)

Net: Tuesdays 7:30pm 147.21 Repeater