New Ham Workshop

Today's Date

Presented by:

ARES of Montgomery County Texas

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Authorized Technician Class Bands

- 80m 3.525-3.600 MHz CW/RTTY/Data Only
- 40m 7.025 – 7.125 MHz CW/RTTY/Data Only
- 15m 21.025 – 21.200 MHz CW/RTTY/Data Only
- 10m 28.000 – 28.300 MHz CW/RTTY/Data Only
  28.300 – 28.500 MHz Voice
- 6m 50.0-54.0 MHz all modes
- 2m 144.0-148.0 MHz all modes
- 1.25m 222.0 – 225.0 MHz all modes
- 70cm 420 – 450 MHz all modes
- 33cm 902 – 928 MHz all modes
- 23cm 1240-1300 MHz all modes

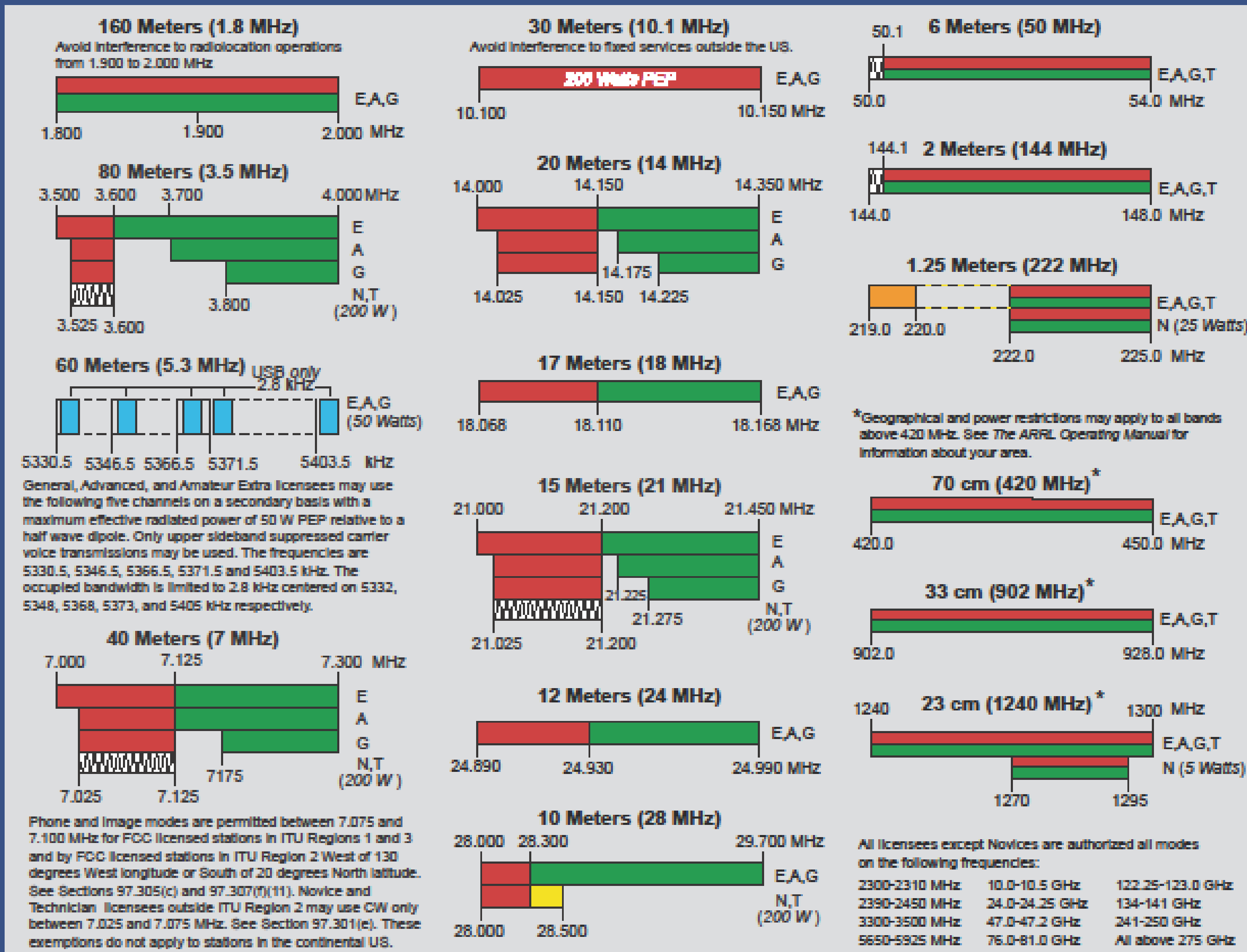
US Amateur Radio Bands

US AMATEUR POWER LIMITS

At all times, transmitter power should be kept down to that necessary to carry out the desired communications. Power is rated in watts PEP output. Except where noted, the maximum power output is 1500 Watts.

Effective Date
February 23, 2007

Published by:
ARRL The national association for AMATEUR RADIO
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494



KEY

Note:
CW operation is permitted throughout all amateur bands except 60 meters.

MCW is authorized above 50.1 MHz, except for 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone only
- = Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See ARRLWeb at www.arrl.org for more detailed band plans.

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Band Edges

6 kHz

Upper Side Band

Lower Side Band

- Avoid the upper and lower band edges by +/- 3 kHz from the dial reading to prevent exceeding the band edge limits.

Technician Class
Max Power Output

- HF bands (80-10m) maximum power output is 200W PEP.;6m and above maximum power output is 1500W PEP
- **Note: Power output is subject to compliance with FCC Publication OET 65.**
- **PEP is Peak Envelope Power defined as :**

Peak envelope power (PEP) is the average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope, under normal operating conditions. The United States Federal Communications Commission uses PEP to set maximum power standards for amateur radio transmitters. The PEP output of an AM transmitter at full modulation is four times its carrier PEP; in other words, a sold-state, 100-watt amateur transceiver is usually rated for no more than 25 watts carrier output when operating in AM.

Authorized Modes

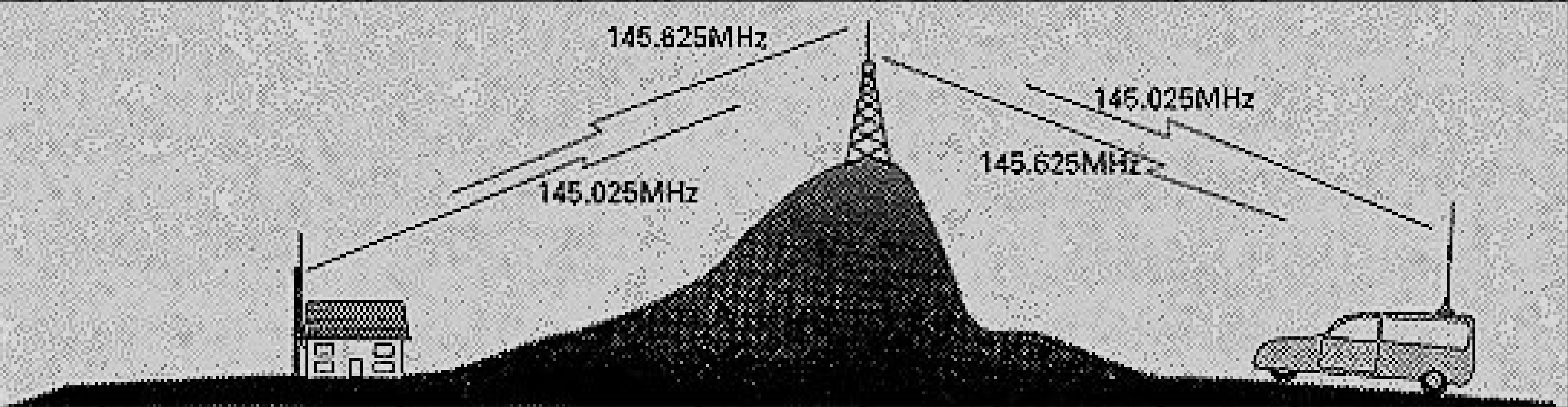
- Technicians are limited to CW, RTTY, and Data modes on the Technician portions of the HF bands 10m*-80m.
- Technicians may use any mode available to a higher class licensee on the 6m and above bands.

*Technicians may use SSB voice on 28-300-28.500 MHz.

On Air Operations
(As they pertain to Technician class operation only)

- 2m/440 FM Repeater Usage

- Definition of Repeater: A repeater is an automatic amateur radio station that receives a signal on one frequency and simultaneously retransmits (repeats) it on another frequency. Repeaters are permitted on frequencies 10m and above.



Repeater Offset

- An offset is the difference between a repeater's transmit and receive frequency. Standard offsets are as follows:

  2 m: Standard Offset 600 kHz.
  For frequencies below 146.995 MHz, a negative offset is used. For frequencies above 147.000 MHz a positive offset is used.

  70cm: Standard Offset 5MHz.
  Frequencies below 445.0 MHz use a positive offset
  Frequencies above 445.0 MHz use a negative offset.

- **Note: Repeater offsets are common convention and are not bound by any rules. Non typical offsets may be used. Check with local users to determine if non standard offsets are being used.**

  Most transceivers do this automatically with a function called ARS, Automatic Repeater Shift.

OFFSETS

- The standard offsets for HF/VHF/UHF/SHF are:
  - 29 MHz 100 kHz (-)
  - 50 MHz 500 kHz (-)
  - 145 MHz 600 kHz (-)
  - 146 MHz 600 kHz (+ or -)
  - 147 MHz 600 kHz (+)
  - 222 MHz 1.6 MHz (-)
  - 440 MHz 5.0 MHz (+ or -)
  - 900 MHz 25.0 MHz (-)
  - 1.2 GHz 12 MHz (-)
  - 2.4 GHz 20 MHz (-)

Tones (CTCSS/DCS)

- Repeaters may use a sub-audible tone (CTCSS) or a digital coded squelch (DCS) to activate the repeater each time the user keys their microphone. Tones prevent noise from keying up the repeater and also allow several different talk groups to share a repeater without interfering with each other.

- CTCSS and DCS may be enabled on the users radio in the receive mode to quiet the receiver except when the correct tone is decoded.

- **Note: CTCSS is Continuous Tone Controlled Squelch System and is sometimes referred to by the Motorola Trade Name of "PL" tone, which stands for Private Line.**

CTCSS Frequencies / DCS Codes

CTCSS TONE FREQUENCY (Hz)					
67.0	69.3	71.9	74.4	77.0	79.7
82.5	85.4	88.5	91.5	94.8	97.4
100.0	103.5	107.2	110.9	114.8	118.8
123.0	127.3	131.8	136.5	141.3	146.2
151.4	156.7	159.8	162.2	165.5	167.9
171.3	173.8	177.3	179.9	183.5	186.2
189.9	192.8	196.6	199.5	203.5	206.5
210.7	218.1	225.7	229.1	233.6	241.8
250.3	254.1	–	–	–	–

DCS CODE									
023	025	026	031	032	036	043	047	051	053
054	065	071	072	073	074	114	115	116	122
125	131	132	134	143	145	152	155	156	162
165	172	174	205	212	223	225	226	243	244
245	246	251	252	255	261	263	265	266	271
274	306	311	315	325	331	332	343	346	351
356	364	365	371	411	412	413	423	431	432
445	446	452	454	455	462	464	465	466	503
506	516	523	526	532	546	565	606	612	624
627	631	632	654	662	664	703	712	723	731
732	734	743	754	–	–	–	–	–	–

Repeater Coverage

- Repeater coverage- Repeaters in the 6m bands and higher typically have line of sight coverage to the radio horizon. The distance to the radio horizon may be estimated using the formula: $D=\sqrt{h}\sqrt{2}$

  Where D = Distance in miles and h = antenna height above sea level in feet.

- For example, an antenna that is 20 feet high at sea level would have a theoretical line of sight to the radio horizon of ~6 miles.

- This formula of course assumes that there are no obstructions (buildings, trees, etc.) between the antenna and the horizon and ignores the effects of propagation anomalies.

10m SSB Phone Operation

- Technician class licensees may operate in the 10m phone portion of the band between 28.300 and 28.500 USB with a maximum of 200W PEP.
- During band openings, 200W is more than enough power to work the world with a simple wire dipole antenna at least one wavelength off the ground.
- By convention, upper sideband is used on 10m.

ITU Phonetic Alphabet Review

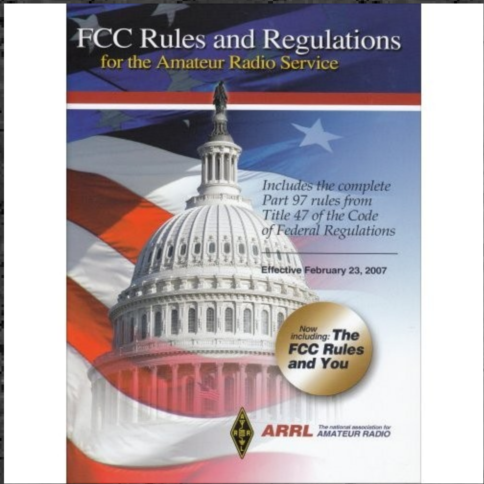
- Amateur Radio Operators utilize the ITU Phonetic Alphabet. Other Phonetic Alphabets may be encountered on the air, but in practice, the ITU Phonetics are recognized worldwide and should be adhered to. Avoid using you own cute, made up phonetics on the air.

A- Alpha	F-Foxtrot	K-Kilo	P-Papa	U-Uniform	Z-Zulu
B-Bravo	G-Golf	L-Lima	Q-Quebec	V-Victor	
C-Charlie	H-Hotel	M-Mike	R-Romeo	W-Whiskey	
D-Delta	I-India	N-November	S-Sierra	X-Xray	
E-Echo	J-Juliet	O-Oscar	T-Tango	Y-Yankee	

- Also avoid using CB slang, “10 codes”, or other “public service” type radio transmissions. Remember, according to FCC rules, amateur radio transmissions must use <u>plain language only</u>.

Prohibited Communications

- Communications involving monetary gain
- Profanity
- False Distress Calls
- Codes, Ciphers, or Deceptive transmissions
- Although not prohibited, communications involving politics, religion, or other controversial topics should generally be avoided.



Net Operations

- Directed Emergency or Simulated Emergency Nets

- Emergency and simulated emergency nets will always have a net control station (NCS) present. It is very important to follow the instructions of the net control station as far as how to check in, what type of traffic to pass, etc.

- Once you have checked in, do not transmit again unless directed to by the net control station. If in doubt as to whether to transmit or not, don't. Only use plain language and ITU phonetics when involved in an emergency net.

- Tactical call signs may be used if approved ahead of time. Do not forget to identify at each 10 minute interval and at the end of your transmission with your FCC call sign in addition to any tactical call sign being used.

General Purpose Nets
Traffic Handling Nets

- General Purpose nets may or may not have a net control station.

- These nets are much more informal and may take on a “roundtable” type discussion. As with the directed nets mentioned above, the net control station (if applicable) will give instructions for checking in.

- **Note: Regardless of net type (directed emergency, simulated emergency, general purpose, or ragchew) if a station breaks in with an emergency, all traffic should cease and priority given to the breaking station.**

Basic Antenna Theory

- Horizontal vs. Vertical Polarization

- Polarization direction refers to the plane of the radiated signal relative to the Earth's surface. Mobile antennas are nearly always vertically polarized, as are repeater antennas.

Basic Antenna Theory

- If the transmitting and receiving stations are using opposite polarity, then the penalty in signal strength can be as high as 20dB.
- Sensitivity to polarity becomes more critical as frequency gets higher and/or distance between the stations becomes greater. There are certain polarities used by convention as noted below:

Basic Antenna Theory

- VHF/UHF FM: Vertical Polarization
- VHF/UHF SSB/CW: Horizontal Polarization
- HF: Polarity isn't nearly as important at HF frequencies due to the behavior of the longer wavelengths involved and their tendency to be reflected within the atmosphere.
- HF signals are bent and twisted as they travel through the ionosphere and rarely arrive at the receiving station in the same polarity as they left the transmitting station.
- For HF frequencies, radiation angle may become a more important consideration depending on where you are trying to communicate with. For short range communications out to several hundred miles, a Near Vertical Incidence Skywave (NVIS) antenna (horizontal dipole or inverted V close to the ground) will usually provide more reliable coverage than a beam antenna on a 100 foot tower.
- Ground mounted vertical HF antennas typically have lower angles of radiation that are suited for DX communication and poor for local or regional communications.

Antenna Types (Vertical, dipole, beam)

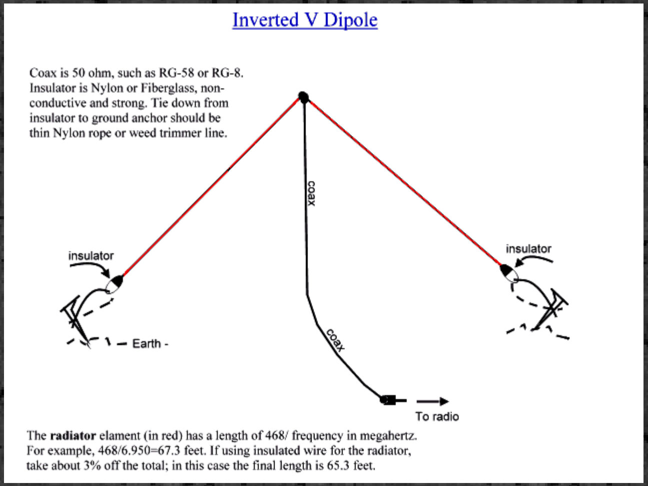
- Vertical- Vertical antennas are typically seen in VHF/UHF FM use as noted above.
- These antennas are usually end fed and use either the body of an automobile or a set of horizontal radials as the ground plane.
- Vertical antennas radiate fields that are perpendicular to the Earth's surface and have an omnidirectional pattern.

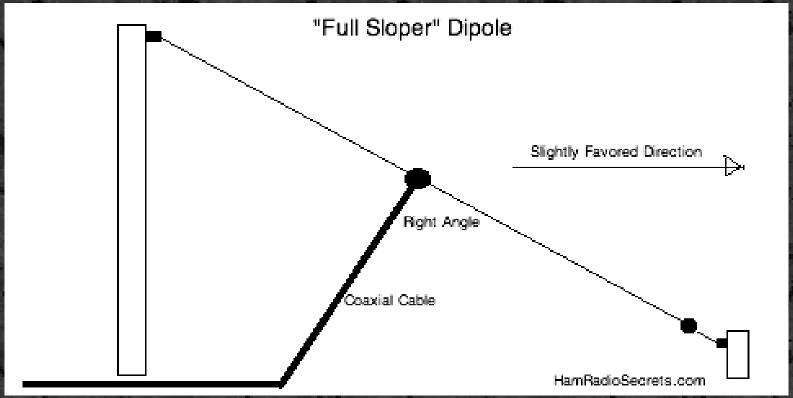
Antenna Types (Vertical, dipole, beam)

- Dipole- Dipole antennas are just as the name implies, "two poles".
- A simple dipole consists of two equal length wires that are cut to resonate at a specific frequency of interest and is usually center fed.
- A Dipole is usually installed in a horizontally polarized configuration, but may be assembled in an inverted V or even vertical installation depending on the available space and desired communications.
- Dipoles are used mostly on HF frequencies, but there is no reason to exclude them on VHF/UHF frequencies.
- Dipole radiation patterns have two major lobes that are broadside to each conductor, with sharp nulls off the ends.
- The formula for the end to end length of a half wave dipole is approximated by 468/f, where f = frequency of interest in MHz.

Antenna Types (Vertical, dipole, beam)

Dipole Antennae





Antenna Types (Vertical, dipole, beam)

- Beam – Beam antennas are highly directional antennas that focus their energy in a single direction, hence the name beam.

- Beam antennas differ in construction from the verticals or dipoles in that beams have multiple antenna elements located on a common boom.

- A beam consists of a driven element, which is the element that the feedline is connected to, along with a complement of reflector and director elements.

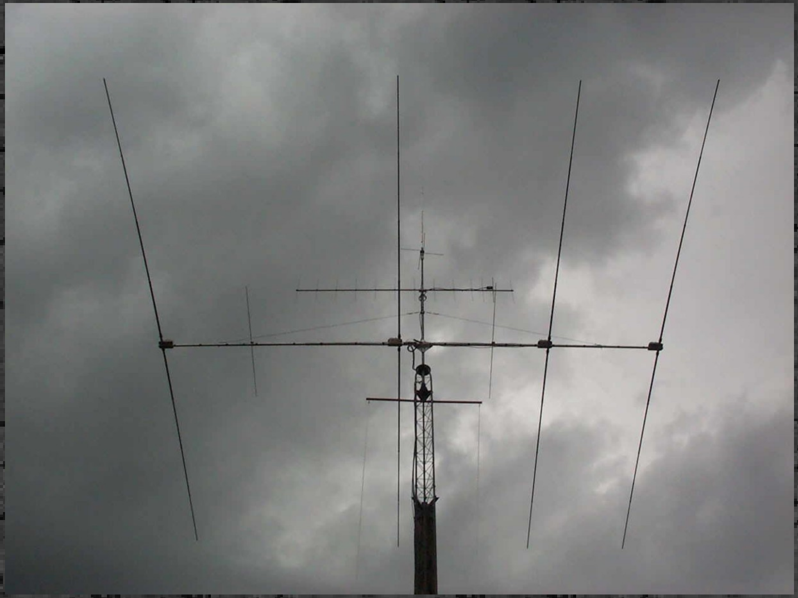
- Typically a beam antenna with more elements has a greater gain than a beam with fewer elements.

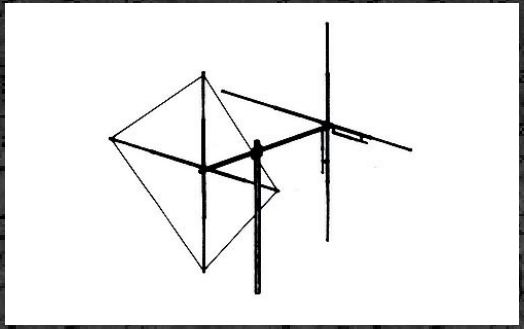
- The advantage of using a beam is that the antenna has maximum sensitivity in only one direction, making it superior to an omnidirectional antenna as far as signal levels are concerned. The downside to beams is that they do not transmit or receive very well at any direction other than where they are pointed. Beams are also relatively complex, more expensive than an omnidirectional antenna, and require a system to aim them in the desired direction.

- Beam antennas have very high gain figures in the intended direction only, with deep nulls to the side and a minor lobe to the rear.

Antenna Types (Vertical, dipole, beam)

Beam Antennae





Basic Antenna Theory

- Antenna Gain
- Manufacturers specify the gain of their antennas as a relative indicator of performance. Gain is always expressed using the logarithmic quantity decibel, abbreviated dB.
- Manufacturers may further specify that a particular antenna has a gain such as "10 dBi" or "6 dBd".
- dBi refers to gain relative to an ideal isotropic radiator (which does not exist in reality).
- dBd refers to gain relative to a standard half wave dipole antenna. **Do not purchase an antenna based on specified gain figures alone**. Also consider construction type, materials used, ease of tuning, availability of parts, difficulty of mounting, etc.
- Since the dB is a logarithmic function rather than a linear one, an antenna with 6dB gain has four times the gain of it's reference, not six times as one might think.
- Don't forget that any advertised gain of an antenna can quickly become null and void if long and/or poor quality feedlines are used.

Questions ?

Additional Resources & Links

- www.eham.net
- www.qrz.com
- www.arrl.net
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