


Who Knows What


VHF and UHF– Making it Work!



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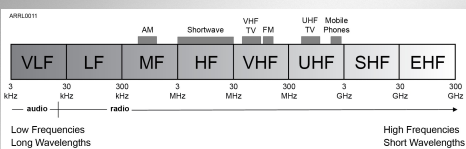
Agenda

- VHF and UHF frequency characteristics
- Equipment Influence
- Antennas



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The VHF and UHF Frequencies



ARRL0111

VLF	LF	MF	HF	VHF	UHF	SHF	EHF
3 kHz	30 kHz	300 kHz	3 MHz	30 MHz	300 MHz	3 GHz	300 GHz
audio	radio						
Low Frequencies Long Wavelengths				High Frequencies Short Wavelengths			

- A VHF wavelength is approximately 79", or 2 meters
- A UHF wavelength is approximately 27.6" or 70 centimeters



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Propagation - Line-of-Sight

- The primary propagation mode for VHF and UHF signals is line-of-sight.
- Radio energy travels in a straight line from a transmitting antenna to a receiving antenna – called the *direct path*
 - There is some attenuation of the signal as the radio wave travels due to spreading out



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Reflect, Refract, Diffract

- Radio waves are reflected by any conductive surface
 - Ground, water, buildings
- *Refraction* or bending occurs when waves encounter a medium having a different speed of light, such as water or an electrical feed line.

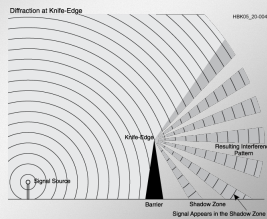


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Reflect, Refract, Diffract

- *Diffraction* occurs when a wave encounters a sharp edge (*knife-edge propagation*) or corner



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VHF and UHF Propagation

- Range is slightly better than visual line of sight due to gradual refraction (bending), creating the *radio horizon*.
- UHF signals penetrate buildings better than HF/VHF because of the shorter wavelength.
- Buildings may block line of sight, but reflected and diffracted waves can get around obstructions.
- *Multi-path* results from reflected signals arriving at the receiver by different paths and interfering with each other.
 - *Picket-fencing* is the rapid fluttering sound of multi-path from a moving transmitter



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“Tropo” - Tropospheric Propagation

- The troposphere is the lower levels of the atmosphere – to about 30 miles high where VHF and UHF typically operate
- Radio waves can be reflected or *scattered* by clouds, rain, and density variations in the troposphere – range up to about 300 miles
- Temperature inversions and weather fronts can form *ducts* that trap and conduct VHF and UHF radio waves for hundreds of miles

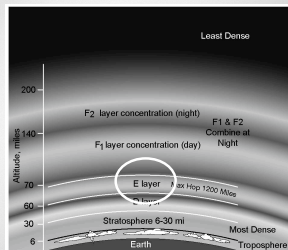


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Sporadic E (Es) and Aurora

- Highly ionized patches of the E layer can reflect HF and VHF signals – best on 10, 6, and 2 meters.
- Aurora near the north and south poles can also reflect VHF and UHF waves with a distinctive distorted sound.




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VHF and UHF Behavior

- A VHF signal can penetrate objects easily, unlike UHF.
- VHF is also able to travel farther. If both waves were transmitted over a stretch of land that had no obstacles, VHF would still be able to travel twice as far
- The difference between these two signals is how they react around structures. Keep in mind, UHF signals are shorter, which will be important around or in buildings, and CARS!
- Metal will not be your friend since radio waves are not able to pass through it, like in CARS!
- If you live in an area with hills, just like metal, a radio signal will be unable to pass through it.

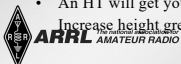


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Distance Expectations

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- The difference between these two signals is how they react around structures. Keep in mind, UHF signals are shorter, which will be important around or in buildings, and CARS!
- Metal will not be your friend since radio waves are not able to pass through it, like in CARS!
- If you live in an area with hills, just like metal, a radio signal will be unable to pass through it.
- An HT will get you 5 or 6 miles direct to another HT on simplex.
- **Increase height greatly changes distances!**




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Equipment

- Handhelds – HT's
 - Convenient and versatile radio – use at home, in the field, or in the car.
 - Typically limited to 5 watts output, but you can add an amplifier to boost the output to 70 watts +. Requires an antenna
 - One radio to learn for home and remote use
- Mobile Radio
 - Can be used anywhere you have a 12-volt supply available – home, car, portable battery in a go kit
 - Can be inexpensive to very capable and costly.
 - Usually 50 watts plus output, just needs a good antenna




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Equipment

- Other Considerations
 - Some equipment is not built to the same specifications as others, and quality of your signal will vary
 - Accessories – handheld microphones for HT's, headsets for both, whip vs rubber duck
 - Additional batteries or power supply for HT's
 - Other modes – APRS, Fusion, DMR, Packet
 - Crossband repeating – using your mobile radio to boost your signal.
- Repeaters
 - Receive signal with an elevated antenna and rebroadcast
 - The 145.17 repeater has a pre-amp to aid incoming signals




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Antennas – or how to really get out!


- Handhelds – HT's
 - Rubber Duck – it works, usually
 - Whip - 30% increase in distance,
 - Magnetic mount antenna – 2db ¼ wavelength, 3.5db ½ wavelength, 5.0 db 7/8 wavelength, to 6.5 db 96" for VHF
 - Base – 100" 6.0 db for VHF
- Mobile Radio
 - At home you can use a magnetic mount or base antenna
 - In the car you can use a magnetic mount.
 - You must tune the SWR of a magnetic mount antenna – the ground plane, mount thickness or height, cable, and antenna all are variables.



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Questions



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