Propagation, Antennas, and Feed Lines **Chapter 4**

Radio Wave Propagation

UHF signals are **direct** (line of sight) **not reflected** by the ionosphere
RADIO HORIZON is distance at which radio signals are **BLOCKED BY THE CURVATURE** of the Earth
EARTH SEEMS LESS CURVED TO RADIO WAVES than light radio travel more than visual line of sight
Long distances **VHF** signals are being **refracted** from a **sporadic E layer**
Sporadic E propagation causes occasional **strong over-the-horizon** signals on **10, 6,& 2 meter** bands
"**KNIFE-EDGE**" signals are **partially refracted** around solid objects exhibiting sharp edges
Tropospheric Scatter causes VHF & UHF communications **over-the-horizon** (~300 miles)
6 meter band is best suited to communicating via **meteor scatter**
TEMPERATURE INVERSIONS in the atmosphere causes "**TROPOSPHERIC DUCTING"**
DAYLIGHT HOURS are generally the best time for long-distance **10 METER BAND PROPAGATION**
Auroral reflection VHF signals exhibit **rapid fluctuations** of strength and often **sound distorted**

The ionosphere is the part of the atmosphere that enables the propagation of radio signals around the world.

Skip > reflect off the **ionosphere**. Loud stations ++1000 miles every 30 sec fading weak to strong
Multi-path Distortion > random reflections
Irregular **fading of signals** > random combining of signals arriving via **different paths**
Picket fencing > Rapid fluttering sound from mobile stations
Data signals over **multiple paths > Error rates** increase on VHF or UHF.
Reflects signals to the repeater using a **directional antenna**
UHF > **penetrate the structure** of buildings

Antenna Polarization

Vertical Antenna > Electric Field is perpendicular to the earth (Flag Pole)
Horizontal Antenna > Electric Field is parallel to the earth (Cloths Line)
Horizontal polarization > long-distance CW/SSB on VHF and UHF
Opposite polarization > significantly weaker line of sight
Skip causes the **polarization** of the original signal to become **randomized**

1 / 4 Wave Antenna > Commonly used antenna (Flag Pole)

Rubber Duck > Common Handheld Radio Antenna (1/4 Wave) NOT as effective as a full size antenna

Diplole Antenna > Two wire antenna (Rabbit Ears) Radiates to the **Broadside**

Directional Antenna > Beam, Quad, Yagi, Dish Concentrates signals in one direction

Reference Antenna > Isotropic Antenna (equal signal in all directions)

Antenna Gain > Increased signal of a directional antenna compared to a reference antenna

Decibel (dB)	**+3 dB = 2X**	**-3 dB = X/2**
	+6 dB = 4X	**-6 dB = X/4**
	+10dB = 10X	

RF Bands > approximately equal the Speed of Light / Frequency (**300 Meters** / F MHz)

Antenna Length > Physical Length (**Shorter is Higher Frequency**)

1/4 Wave Antenna = Physical Length of **234 Ft.** / F MHz)
1/2 Wave Antenna = Physical Length of **468 Ft.** / F MHz)
1 Wave Antenna = Physical Length of 936 Ft. / F MHz)

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Coaxial Cable > Connection between Antenna and Transceiver

Coaxial Cables > Damaged by Moisture, UV cracks & leaks water, AIR-CORE require dry-air, LOST RF = HEAT

Easy to Use, Requires few special installation considerations Low SWR allows efficient transfer of power
Commonly 50 Ohms Impedance, Loss increases with frequency
RG-58 (smaller) more feedline loss
RG-8 (bigger) less feedline loss
Air-Core (Hard Line) lowest feedline loss

Cable Connectors > loose connectors and water leaks most common problems

UHF (**PL-259 or SO-239**) commonly used for HF
N most suitable for above 400 MHz
Seal connectors to prevent moisture leaks that cause feedline loss
Loose connectors might cause erratic SWR

Antenna Tuner > Matches the antenna impedance to the transceiver impedance

Standing Wave Ratio (SWR) > How well is the LOAD (antenna) MATCHED to the Transmission Line

Voltage SWR (VSWR) > Perfect 1:1, Transceiver limit 2:1, MIS-Matched 4:1 (Directional Watt Meter)

Dummy Load > Radio testing WITHOUT radiating RF

Antenna Analyzer > Checks antenna resonance

Soldering > Use ROSIN-Core only, COLD Joint is gray and dull