Near Vertical Incidence Sky Wave (NVIS)

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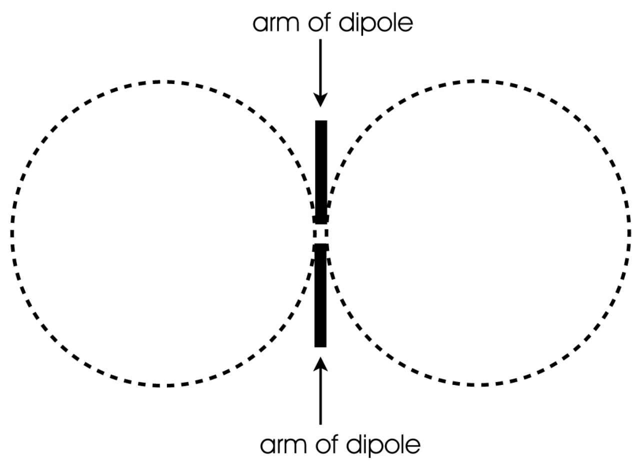

Dipole Radiation Pattern

NVIS propagation is a propagation pattern that uses antennas with high-angle radiation (almost 90 degrees, vertical) and low operating frequencies for a range of about 300 miles.

Long distance propagation uses radio waves that are reflected from the ionosphere and return to earth at some distance away. Radio waves that are radiated at a very low angle, travel a long distance to reach the ionosphere at a very shallow angle and return to earth far away. When the angle of radiation increases, the radio waves reach the ionosphere at a greater angle, and return to earth closer to their point of origin. Signals that reach the ionosphere at a higher angle of incidence will not be reflected at all, but will continue out into space. The area of reflection that would have occurred is the "skip zone". Depending on operating frequencies, antennas, and propagation conditions, this skip zone can start at roughly 12 to 18 miles and extend out to several hundred miles, preventing communications.

NVIS antennas are designed to minimize the ground wave (low takeoff angle) radiation and maximize the sky wave (very high takeoff angle, 60-90 degrees). Essentially, the NVIS antenna radiates a wave almost straight up, then bounces from the ionosphere and returns to the Earth in a circular pattern around the transmitter. Because of the near-vertical radiation angle, there is no skip zone. Communications are continuous out to several hundred miles from the transmitter. The nearly vertical angle of radiation requires the use of lower frequencies, usually 2-10 MHz. This type of propagation is excellent when communicating over hills and mountains. These frequencies are the same frequencies that contain a lot of atmospheric noise, such as distant thunderstorms. The NVIS antenna is optimized for listening to signals from nearby areas, and minimizes the reception of signals from distant sources.

One of the most effective antennas for NVIS is a dipole that is mounted from 0.1 to 0.25 wavelengths above ground. When a dipole is brought very close two ground, the angle of radiation increases. In the range of 0.1 to 0.25 wavelengths above ground, vertical and nearly vertical radiation reaches a maximum. A dipole can be used at even lower heights, resulting in some loss of vertical gain, but often, a more substantial reduction in noise and interference from distant regions. Heights of 5 to 10 feet above ground are not unusual for NVIS operation.

During a test by WOIPL, they used a 75-meter dipole at a height of 30 feet. They found the communications to be difficult. They set up a second dipole at a height of 8 feet. The background noise went from S7 to S3 and the communications with stations 25 miles and further, greatly improved. Many people find the 10 to 15 foot height to be ideal. Field tests have proven that the maximum NVIS efficiency is obtained at the 10 to 15 foot height for frequencies in the 40 meter to 75 meter range.

RACES uses 80 meters for NVIS communications within a state.

For Full Wavelength Antennas:

Frequency (MHz.)	Wavelength (L) (meters	0.1L (meters/feet)	0.25L (meters/feet)
1.9	157.9	15.8 / 51.8	39.5 / 129.6
3.8	78.9	7.9 / 25.9	19.7 / 64.6
5.3	56.6	5.7 / 18.7	14.2 / 43.3
7.2	41.7	4.8 / 15.7	10.4 / 34.1

For 1/2 Wavelength Antennas:

Frequency (MHz.)	Wavelength (L) (meters	0.1L (meters/feet)/2
1.9	157.9	7.9 / 25.9
3.8	78.9	4.0 / 13.0
5.3	56.6	2.9 / 9.4
7.2	41.7	2.4 / 7.9

For 1/4 Wavelength Antennas:

Frequency (MHz.)	Wavelength (L) (meters	0.1L (meters/feet)
1.9	157.9	4.0 / 13.0
3.8	78.9	2.0 / 6.5
5.3	56.6	1.4 / 4.7
7.2	41.7	1.2 / 3.9