

# CALCULATING REPEATER COVERAGE

Information intended to indicate the range of the repeater can be calculated based on antenna heights above average terrain. The object is to determine range or distance from the repeater that will produce 1 microvolt of signal across a 50 ohm antenna at a mobile or home station. The antenna that will be used as a standard is a 1/4wave whip at 30, 150, **and 450 MHz**. To determine what field strength is required to obtain 1 microvolt across the antenna terminals the following formula is used:

$$F_s = \frac{V}{A_p}$$

Where V is the required voltage (1 microvolt) and  $A_p$  is the aperture of the antenna. For example, the required field strength in microvolt/m to produce 1 microvolt across the antenna terminals at 150 MHz is .32 or 3.3 microvolt/m. To convert this figure to decibels refer to the figure charting decibels vs. power or voltage gain or loss. We find that 3.3 microvolts is a ratio of 3.3 to 1 which is +9.6 dB above 1 microvolt.

The next step is to determine the field strength at a given distance from the repeater site. The chart decibels above 1 microvolt vs distance in miles indicates the dB level above or below 1 microvolt/m for transmitter heights of 100 to 500 feet vs the distance in miles. The field strength is based on a mobile or home unit having an effective height of 10 feet above ground and on 1 watt radiated from the repeater antenna.

Let's assume that the repeater antenna is 100 feet high and the transmitter output (not input) is 50 watts. Also, assume that the repeater antenna has a gain of 6 dB. Since the field strength is based on 1 watt radiated, refer to the graph showing power factor in dB vs power correction factor referred to a radiated power of 1 watt. The correction factor for 50 watts is 17 dB. Assume that the feedline is 100 feet of RG-8U which has a loss of 2.5 dB at 146 MHz. Taking the power, antenna gain, and feedline loss (17.0 + 6 - 2.5 dB) the total correction is 20.5 dB.

In the case of 1 watt radiated we had determined that +9.6 dB above 1 microvolt/m was required to produce the 1 microvolt across the antenna terminals of the 1/4wave whip. However, because of the repeater transmitter power and antenna gain minus feed line losses, we must consider this a minus figure because we have improved the propagation conditions. Therefore, -20.5 dB + 9.6 dB = -10.9 dB below 1 microvolt/m.

In the chart of decibels above 1 microvolt vs distance in miles, 10.9 below 1 microvolt/m indicates a distance of approximately 35 miles for a 146 MHz signal and a 100-foot-high antenna.

Information provided by Bill Smith Jr. KB6MCU