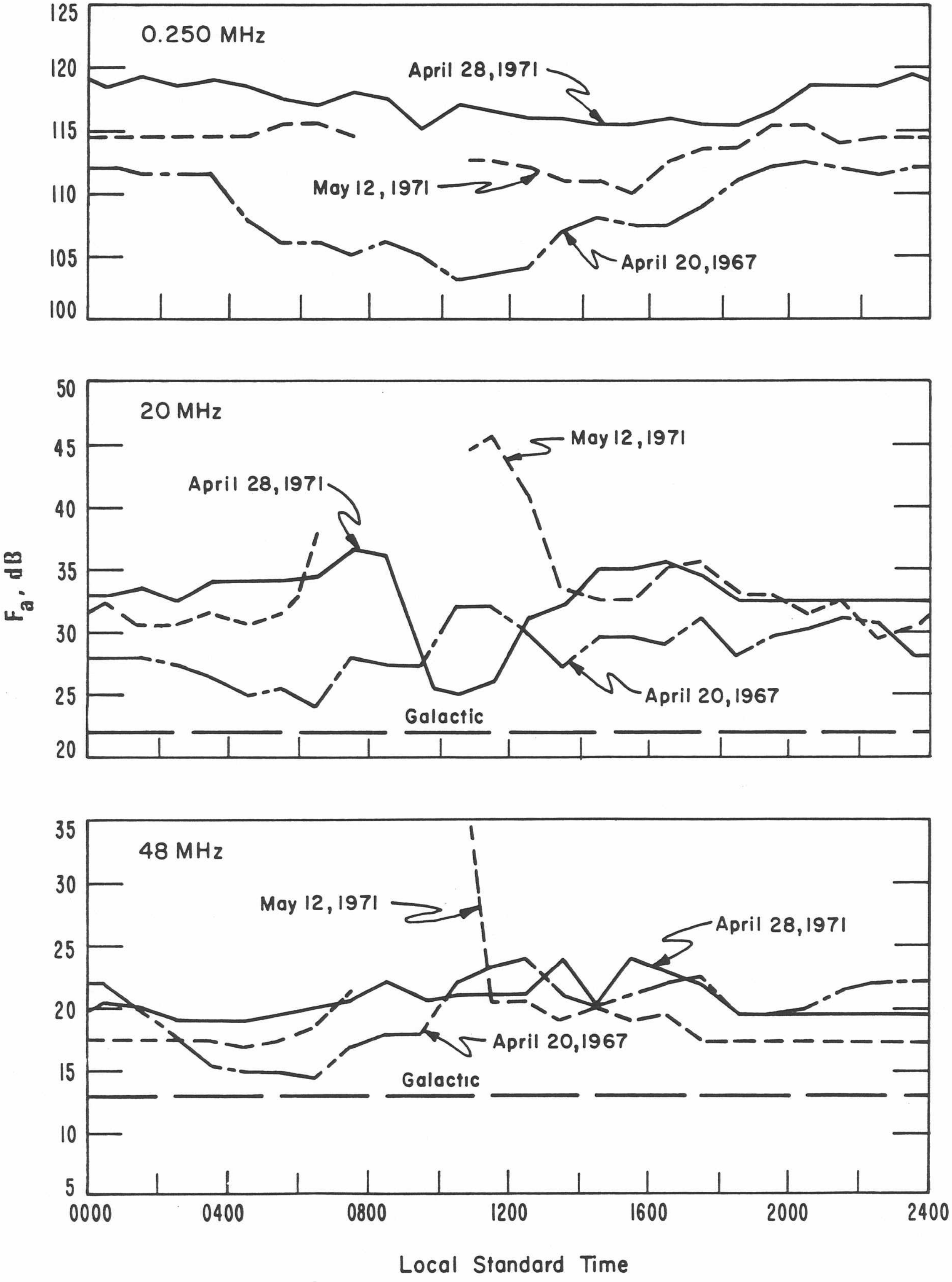

Figure 11. Radio-noise measurements, Dept. of Commerce Boulder Labs, end of Wing 1.

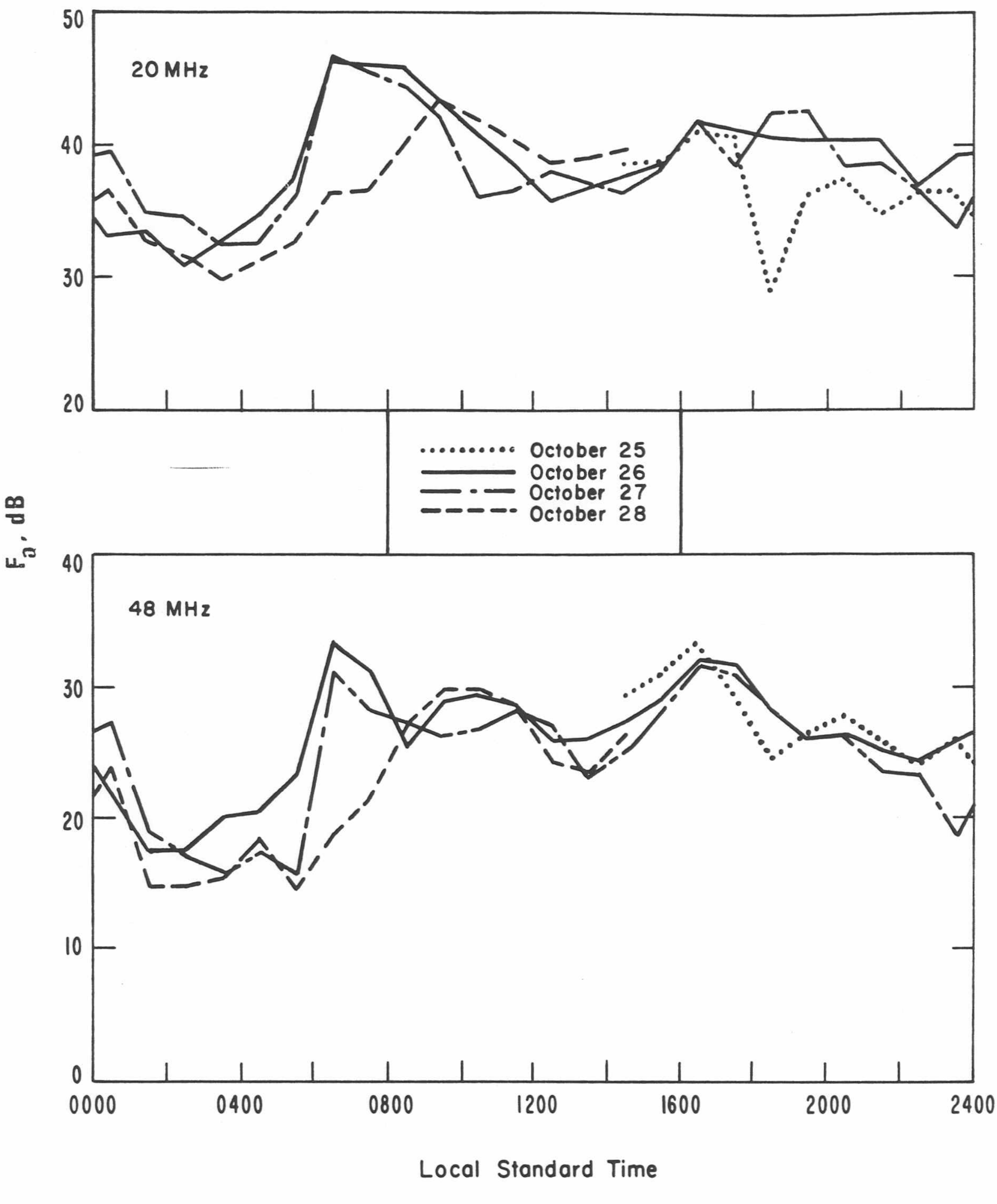

Figure 12. Hourly median values of radio noise, measured near highway in front of Dept. of Commerce Boulder Labs., October 25-28, 1967.

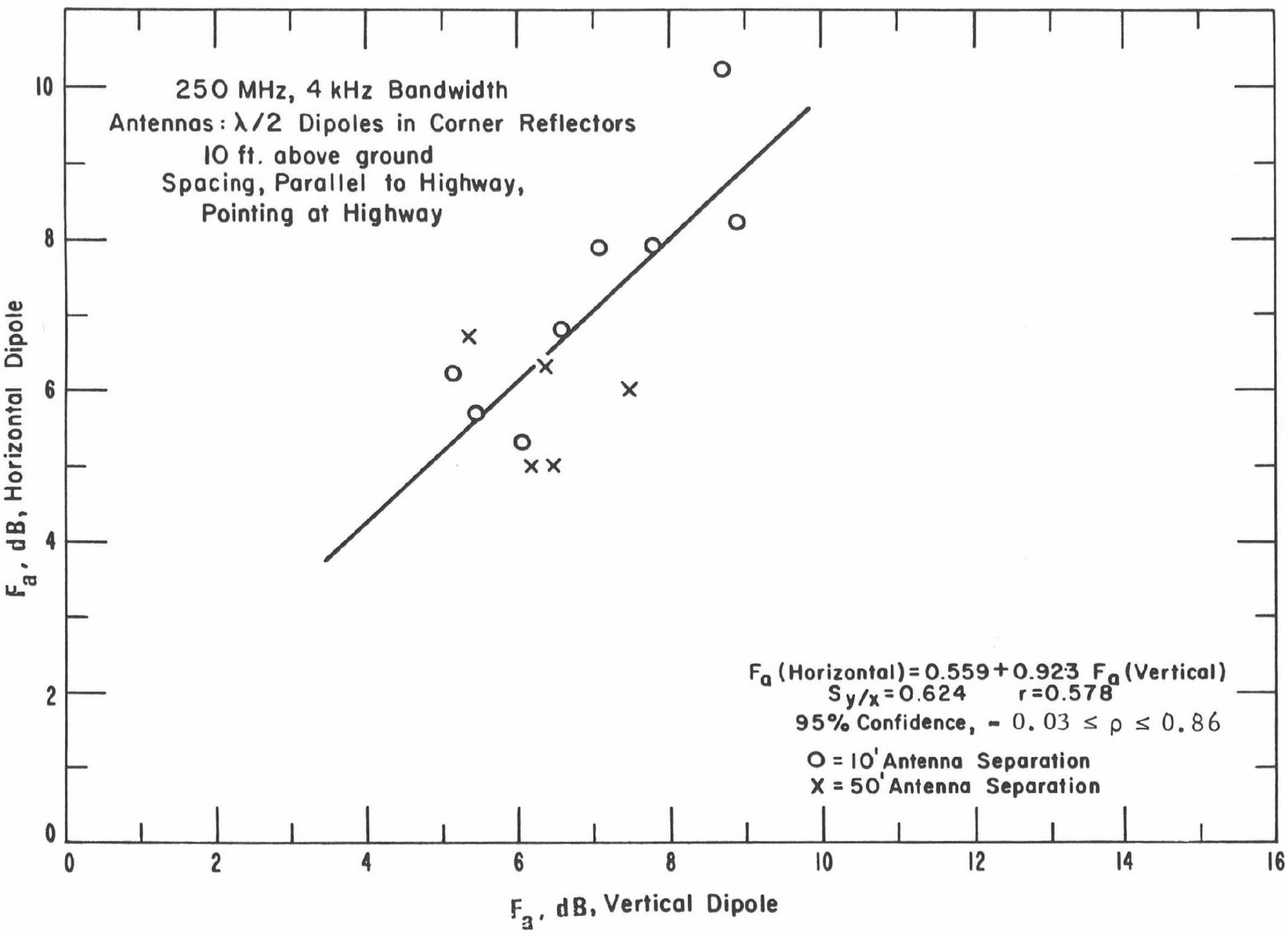

Figure 13. Horizontal versus vertical component of man-made radio noise at 250 MHz.

4.1.2 Power Lines

A number of local features may influence greatly the man-made radio noise level at a given location. One such feature is the proximity of electric power distribution lines. At and below the middle of the HF band, a large part of the received noise is generated by or propagated along power lines. Even in the VHF and UHF bands, however, nearby power lines, especially high voltage lines, can be the source of the predominant man-made radio noise. The mobile radio noise laboratory has been used to measure the decrease in power line noise as a function of distance from the power line. Figures 14 and 15 show examples of such measurements for two power transmission lines. These measurements were made starting directly under the power line and moving perpendicular to the power line until the noise decreased to the ambient level in the area. One set of measurements was made for a 250 kV line located in a rural area of the state of Washington. The 0.5 MHz measurements are shown on figure 14. Another set of measurements was made for a 115 kV line in a rural area in the state of Wyoming. The results of the 102 MHz measurements are shown on figure 15. Both sets of measurements were made using short vertical whip antennas. The physical height of the 0.5 MHz antenna is 0.003 λ, and the height of the 102 MHz antenna is 0.17 λ. When under the power line, the lowest conductor was approximately 15 ft above the top of the antenna. Because of the antennas used, the fall off of the noise with decreasing distance near the line is almost certain to be due to the antenna pattern rather than a decrease in the actual field. A comparison with figure 1 indicates that, for an average location, the power line noise from a 250 kV line at 0.5 MHz would be equal to the expected ambient noise level at distances of approximately 290 m in business areas, 320 m in residential areas, and 350 m in rural areas. Also, the expected ambient noise at 102 MHz and the 115 kV power line noise would be equal at approximately 130 m in a business area, 180 m in a residential area, and 240m in a rural area. These probably are good "rule-of-thumb" distances to use in estimating the effect of nearby power lines.

Figure 16 shows the results of measurements taken along a 115 kV line in rural Wyoming, parallel to the line, under the line, and 400 m from it. The figure shows the results for eight measurement frequencies, the values for each frequency being the median value of values taken along approximately 1 mile of the transmission line. Also shown on figure 16 is the general rural noise characteristic from figure 1. The 115 kV line of figures 14 and 15 had steel towers whereas the 115 kV line of figure 16 was similar but used wooden towers.

The above types of measurements were made for five H-frame, 115 kV power transmission lines in the Boulder area, each line being measured at more than one location. Figure 17 summarizes these measurements, giving the decrease in noise power as a function of the perpendicular distance from the lines. Results are shown for seven measurement frequencies, 0.25 MHz to 250 MHz. The results shown give the expected values, based on the mean values of the measurements of the five lines. The results of figure 1 indicate that F_a decreases with increasing frequency at about 27.7 dB per decade of frequency. The mean value of all the measurements taken under the five H frame, 115 kV lines, and at a distance of 16 meters from the lines are shown on figure 18 along with a least squares fit to the measurements, with the slope restricted to 27.7 dB per decade. Also shown on figure 18 is the standard deviation, σ_{F_a}, for these measurements. The ITS data base does not contain any information on the effect of higher voltage power lines. However, in a recent report (Crippen, 1971), measurements on a 500 kV line indicated that, in the HF region, the effects of the power line could be noticed in a rural area out to a distance of 400 m.

The noise from power lines will vary over wide limits depending on the condition of the line and insulators, type of supports, etc. Variation also will be noted with weather changes. For example, during periods of precipitation, raindrops or snowflakes hitting the line can cause a corona discharge to take place. The highest noise levels probably will be noted at the beginning of a rainstorm after a dry, windy period when the insulators have become covered with dust. When the rain mixes with the dust and before sufficient rain has fallen to wash the insulators, very strong discharges across the insulators will take place. The line voltage appears to have less effect on the level of the radiated noise than the construction and condition of the line. The lower voltage distribution lines will often be noisier than the high voltage transmission lines. This could be due to a basic design philosophy, age and condition of the line, or a difference in line hardware design.

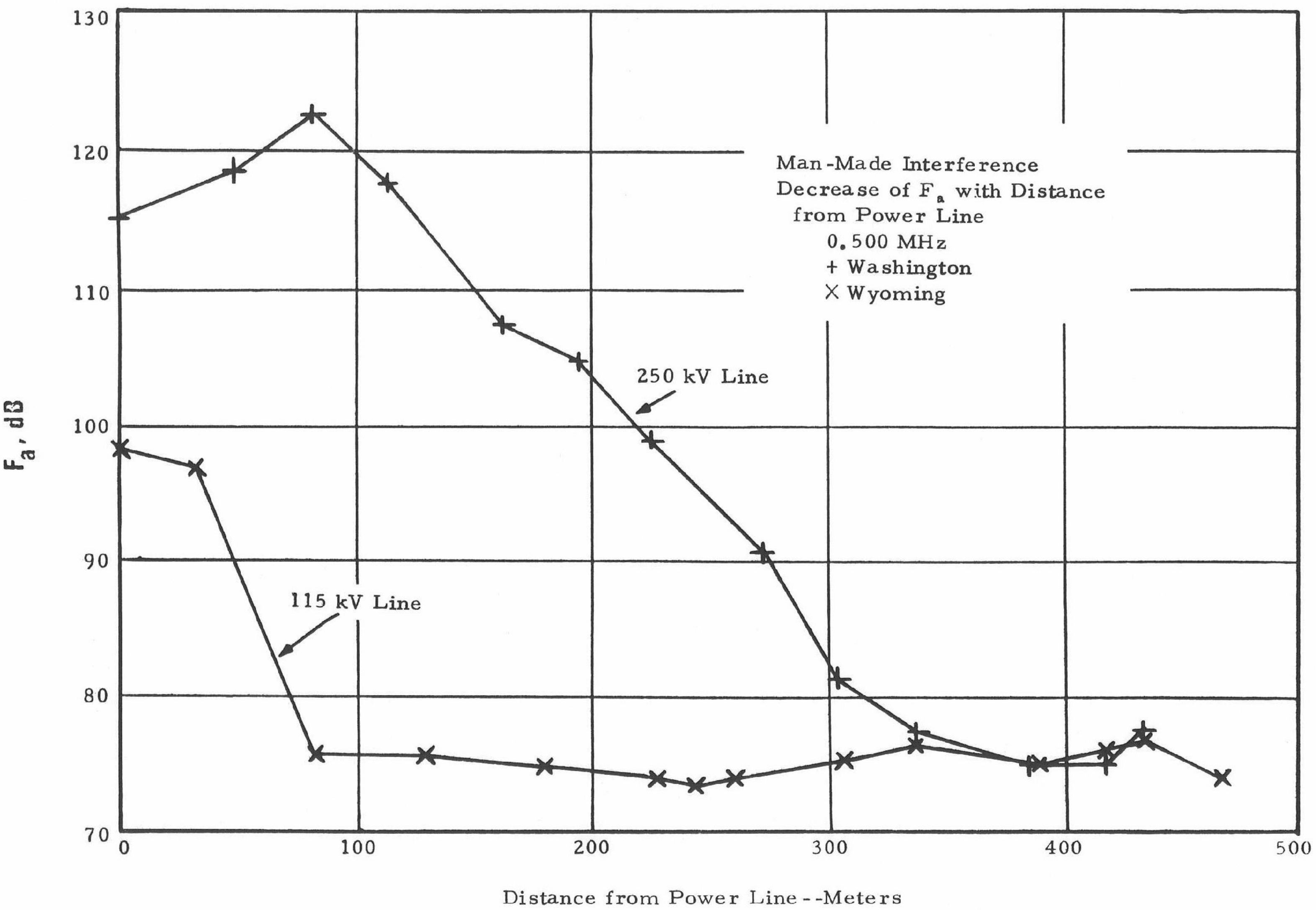

Figure 14. Decrease in power line noise with distance at 0.5 MHz.

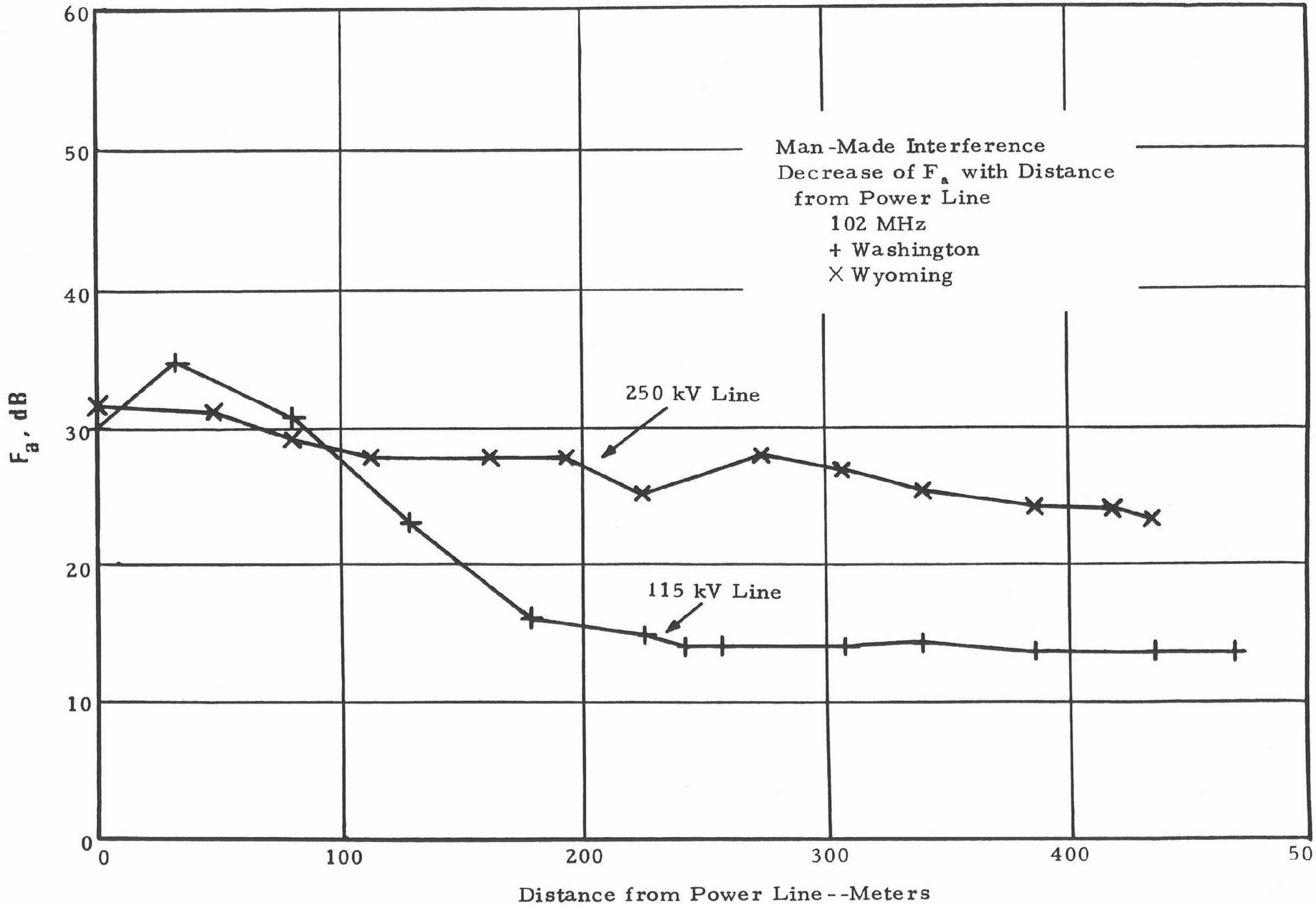

Figure 15. Decrease in power line noise with distance at 102 MHz.

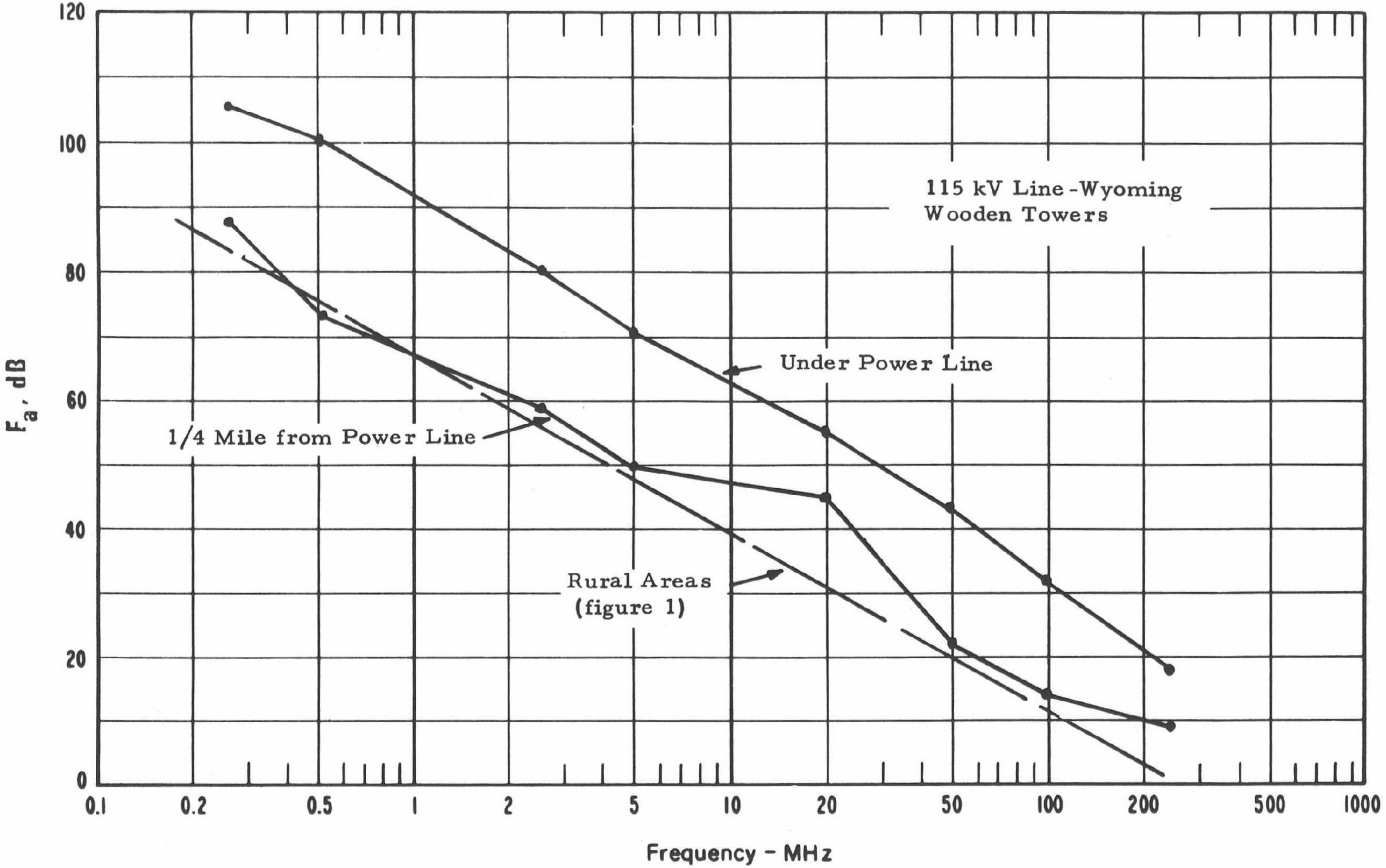

Figure 16. Power line noise measurements taken moving parallel to a 115 kV line in rural Wyoming, both under the line and 1/4 mile from the line.

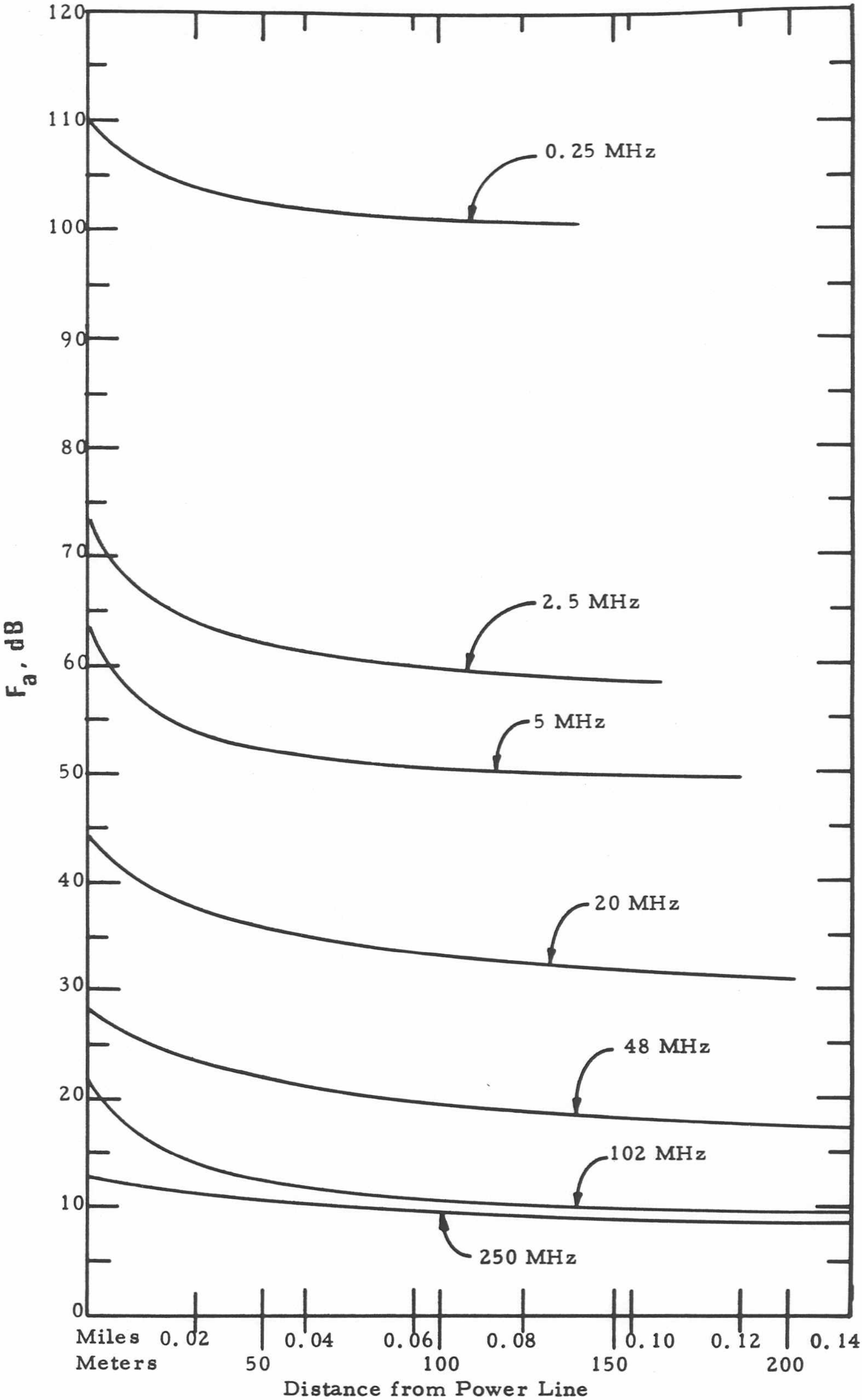

Figure 17. Expected decrease of radio noise radiated from 115 kV H-frame power line with distance from line.