Arizona Seeker Radar Upgrade Radiation MPE Analysis

Updated June 19, 2026

Introduction

This report estimates radiation exposure to personnel at ground level for the proposed upgraded Arizona Seeker radar. The system is a 24x24-element planar array, shown in Figure 1, operating at 440 MHz, with 20% duty factor and 500W peak transmit power per element.

We also consider the effect of adding an extended ground screen and increasing peak power to 700W.

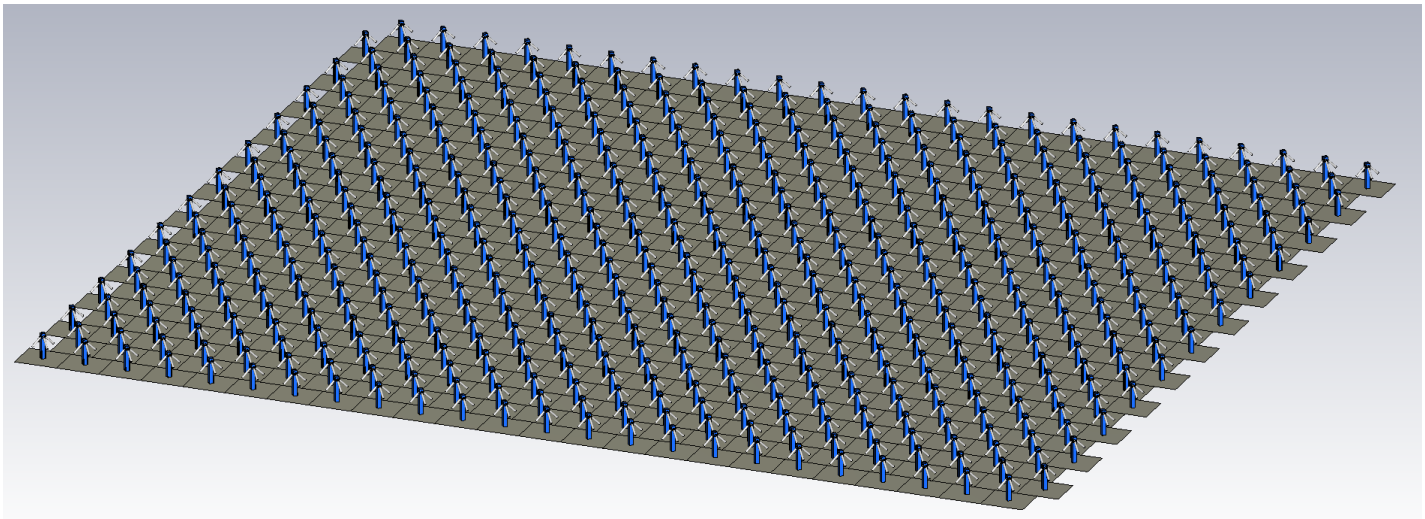


Figure 1: Simulated array layout.

Radiation exposure is evaluated against the FCC maximum permitted exposure (MPE) limits as published in 47 CFR 1.1310. These limits are summarized in the following table:

Exposure Class	Power Density	E-Field Strength (V/m)	E-Field Strength (dB V/m)	Averaging Time (min.)
Occupational	$f_{MHz}/300 = 1.47$ mW/cm^2 = 14.7 W/m^2	74.4	37.4	< 6
Public	f_{MHz} /1500 = 0.29 mW/cm^2 = 2.93 W/m^2	33.2	30.4	< 30

We consider both occupational and public limits in two cases: a zenith-oriented (broadside) beam, and a beam at minimum elevation of 30° above the horizon (60° zenith angle). We analyze the spatial distribution of electric field strength on a plane 2m above, and parallel to, the ground under and surrounding the antenna array.

The public exposure limit is shown as a black contour, and the corresponding occupational limit is shown as a white contour. No margin of safety is applied to the reported figures.

Broadside Beam

Figure 2 shows E-field strength in a 50x50m area centered on the radar for a zenith-oriented beam, 500W transmit power, and no ground screen extension. A minimum exclusion radius of 14.7m (from array center) is required to meet MPE.

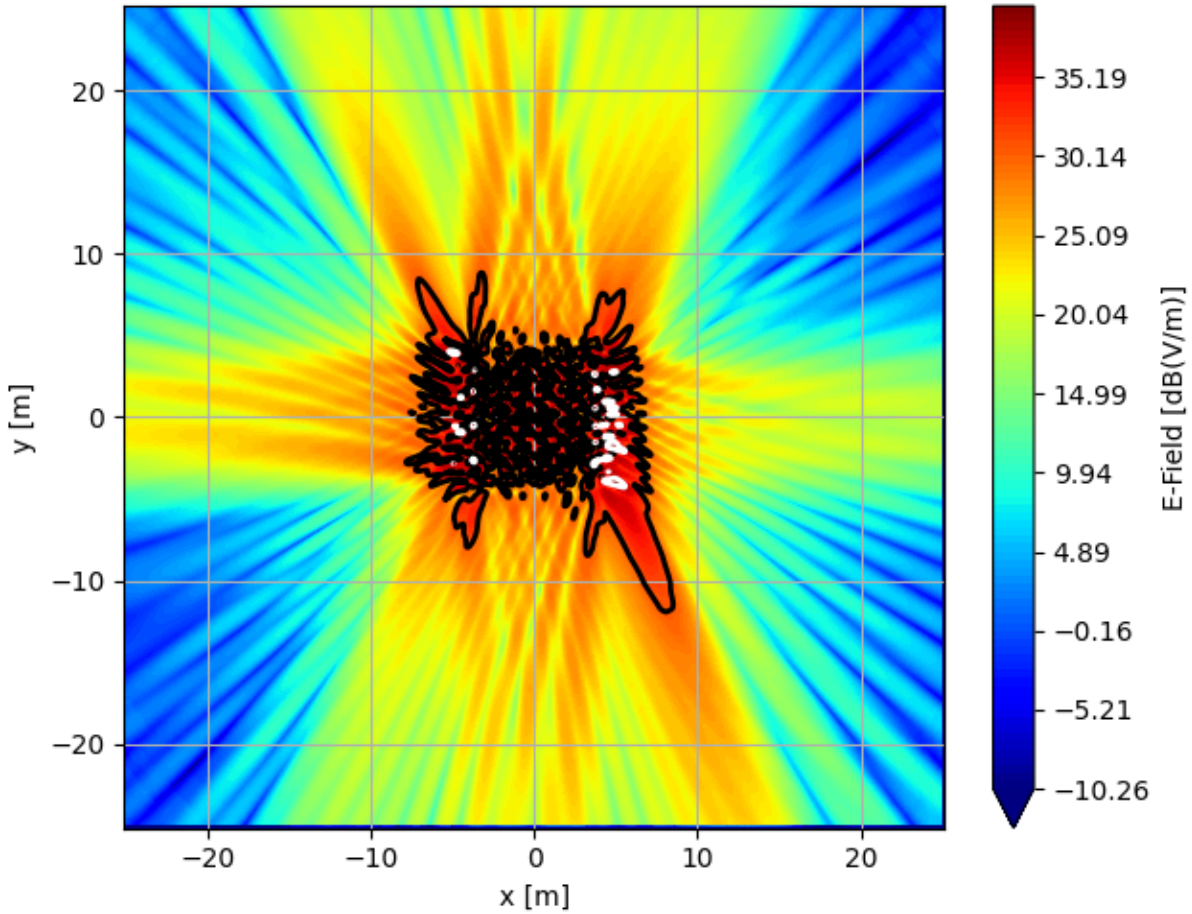


Figure 2: Zenith beam, 500W, no ground extension.

30° Elevation Beam

Figure 3 shows a 250x250m area centered on the radar for a beam with 60° scan angle (30° above horizon), 500W transmit power, no ground screen extension. The minimum exclusion radius for public MPE is 106m.

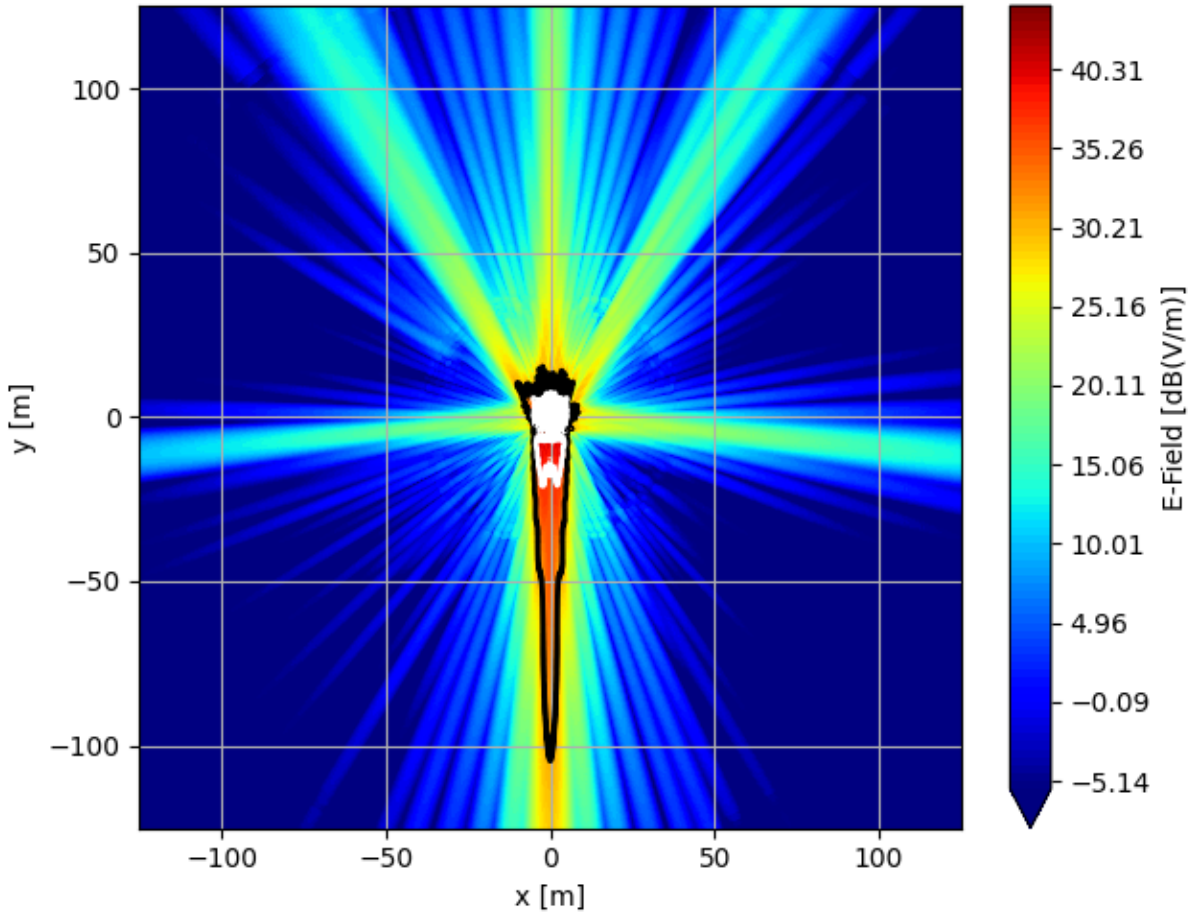
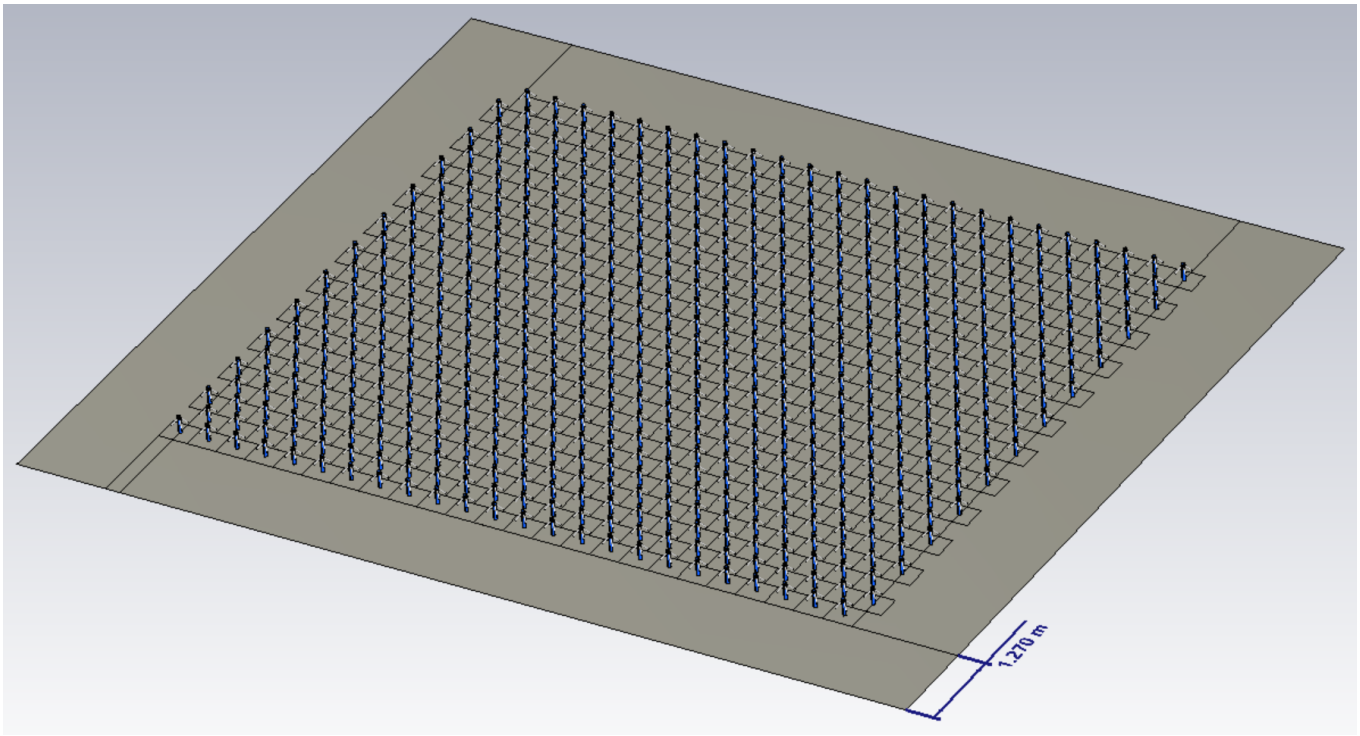


Figure 3: 30°-elevation, 500W, no ground extension.

Ground Screen

The data presented in the preceeding section assumes no extention to the ground plane. In this section we analyze the effect of extending the ground plane, both on radiation exposure and gain. The ground screen extends 1.27m from the nominal outer edge of the antenna reflector, shown in the following diagram.



The results show no effect on broadside gain, and minimum improvement (0.1dB) in gain at maximum scan angle of 60-degrees from broadside (30-degrees elevation from horizon).

For RF MPE, adding a ground screen (Figure 8) reduces the exclusion radius to 79m at maximum scan angle.

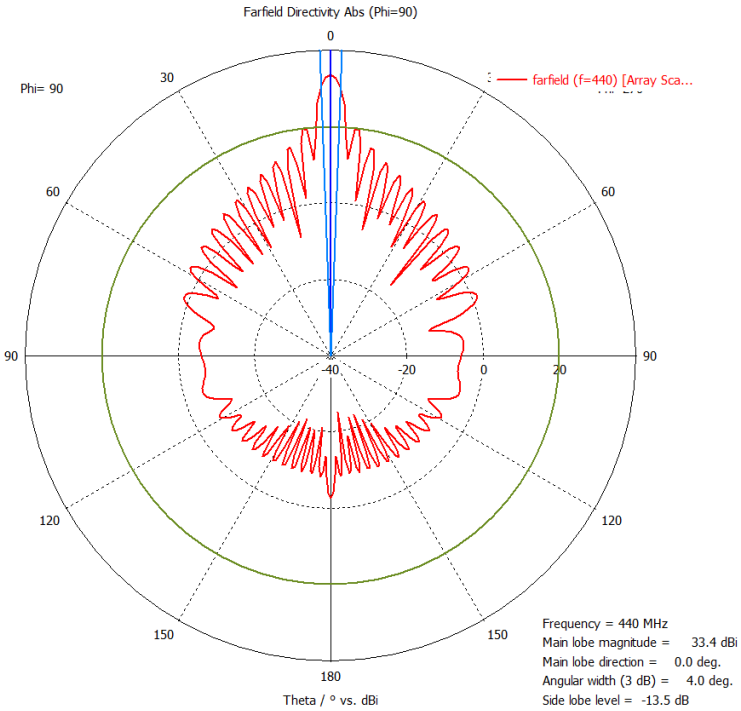


Figure 4: No ground screen, 0-degree scan angle.

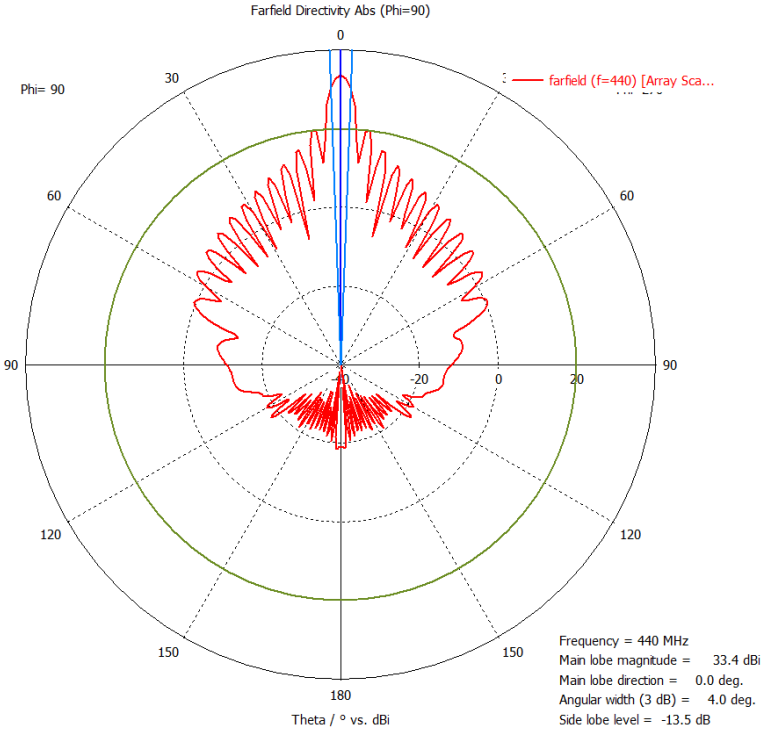


Figure 5: Ground screen, 0-degree scan angle.

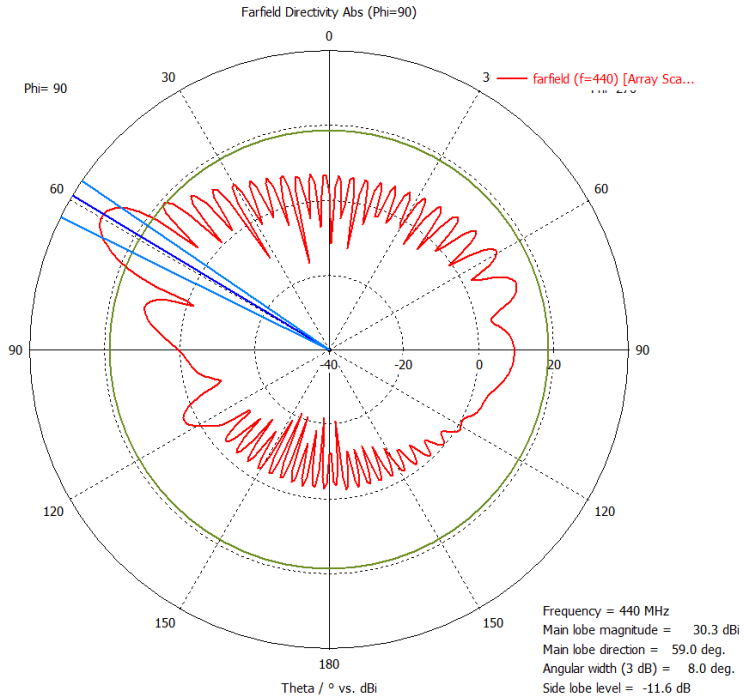


Figure 6: No ground screen, 60-degree scan angle.

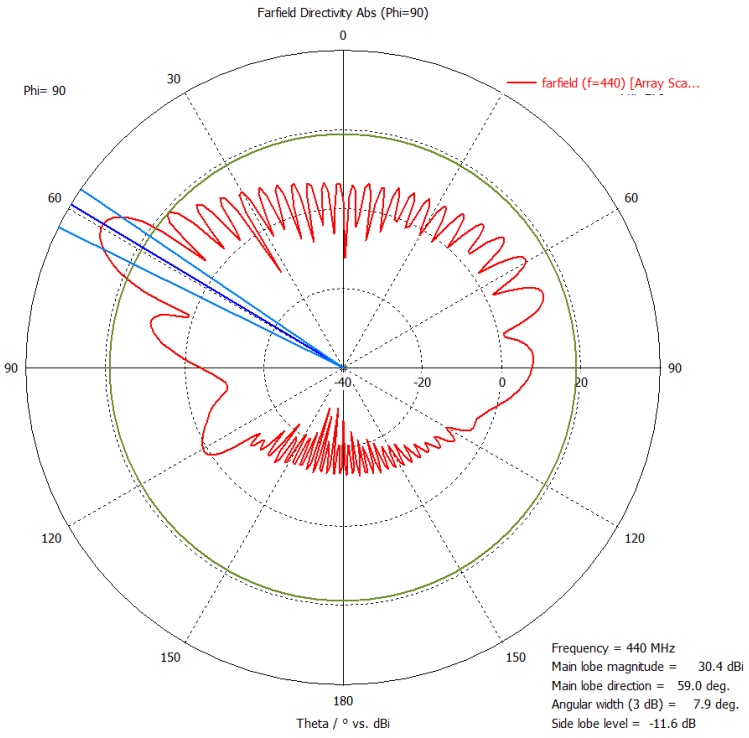


Figure 7: Ground screen, 60-degree scan angle.

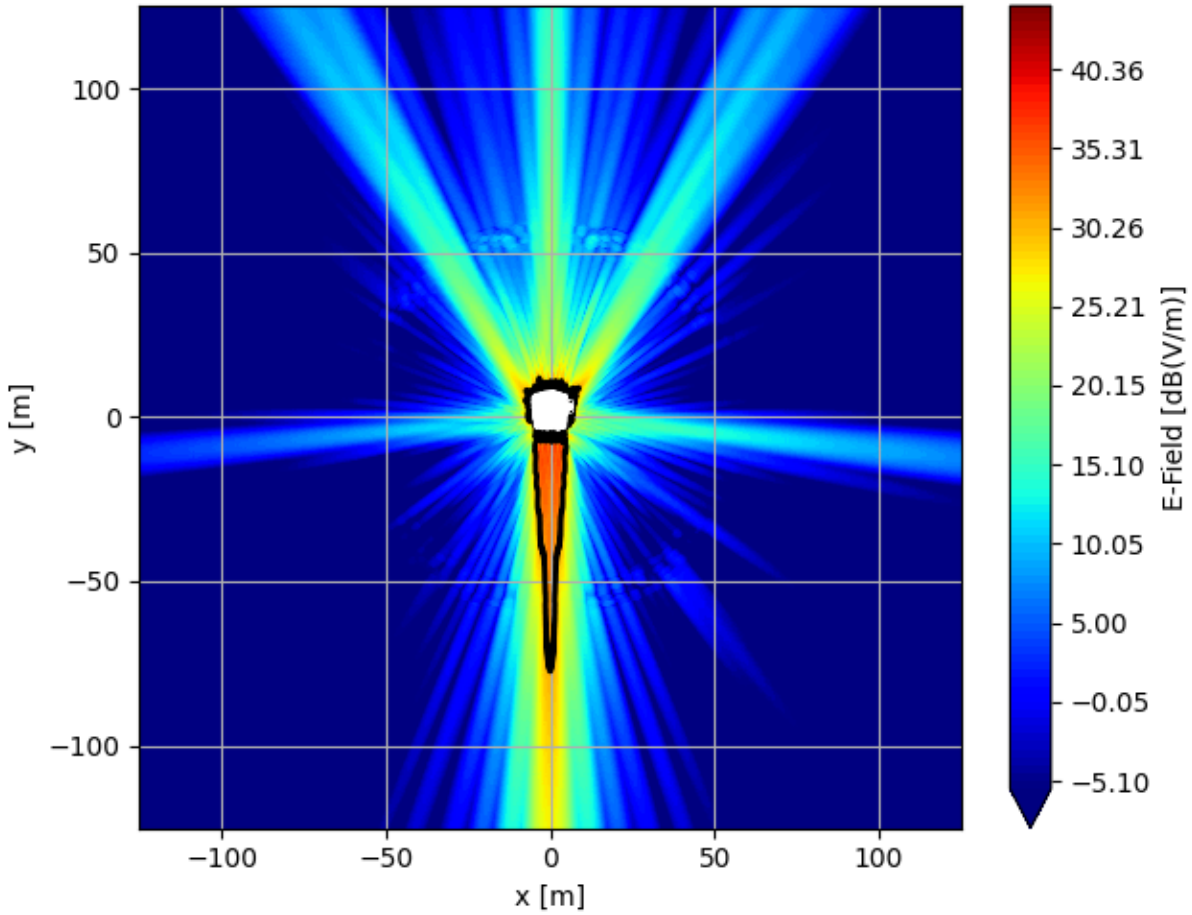


Figure 8: 30°-elevation, 500W, with ground screen extension.

700W Transmit Power

The effect of increasing the peak transmit power from 500 to 700W per element is shown in Figure 9 (with no ground screen extension) and Figure 10 (including a ground screen extension). The minimum MPE exclusion zone radii are 124m and 96m respectively.

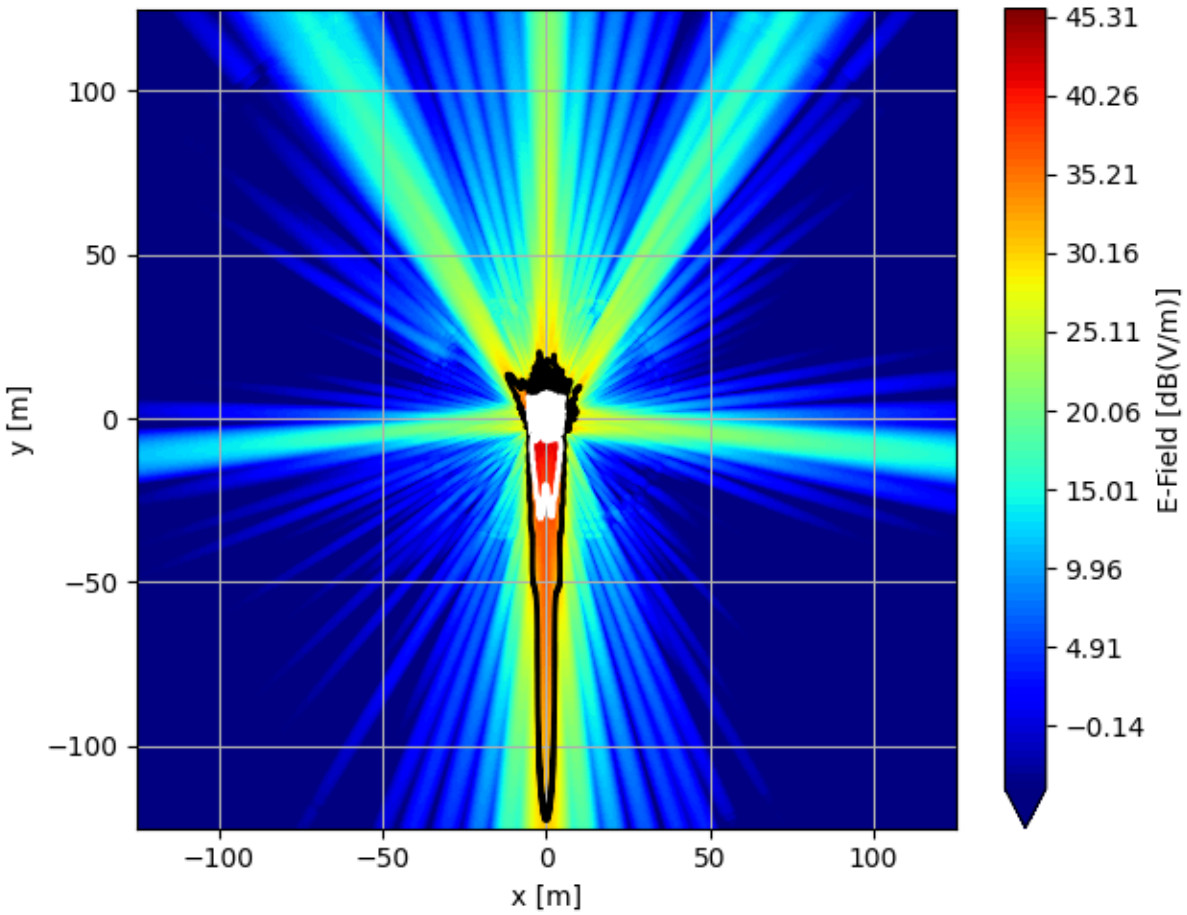


Figure 9: 30°-elevation, 700W, no ground extension.

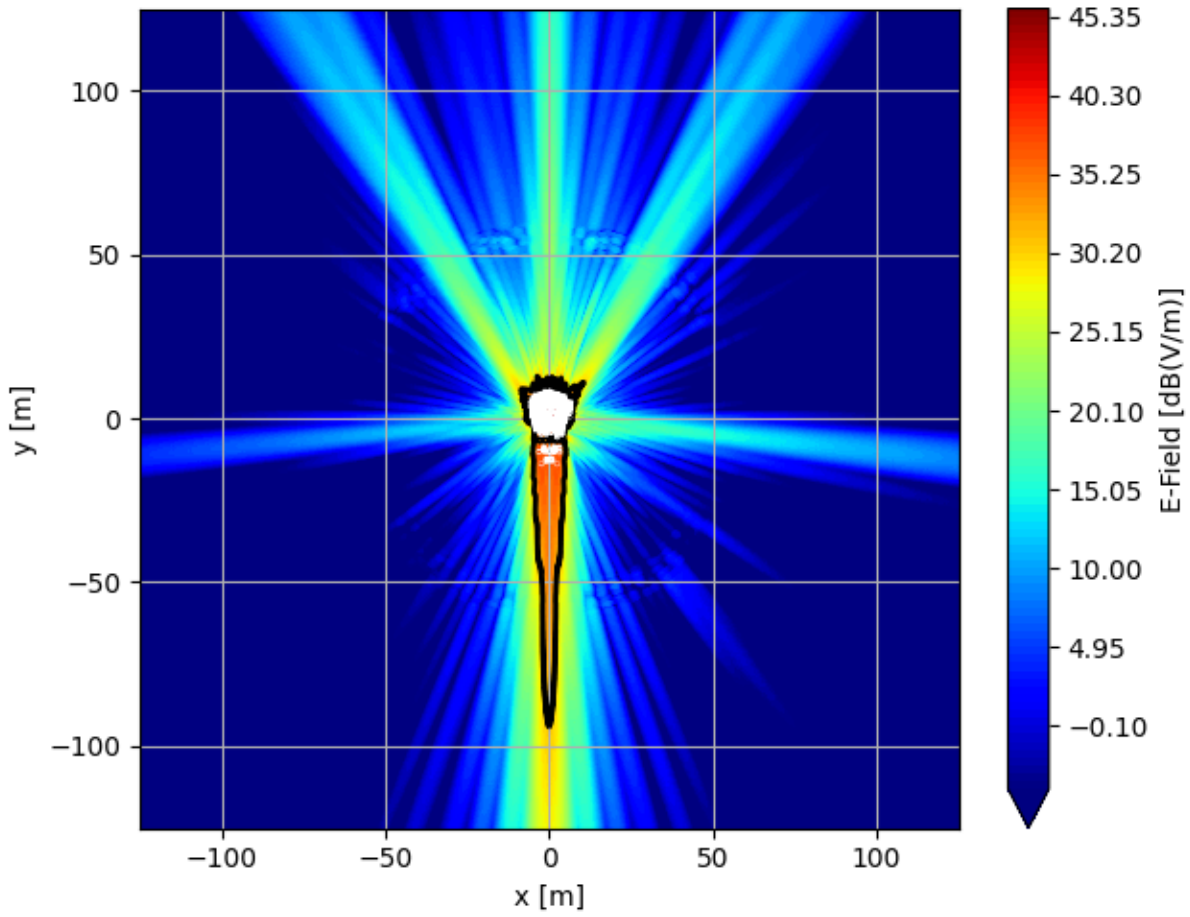


Figure 10: 30°-elevation, 700W, with ground screen extension.

Summary

The following table summarizes the exclusion zone radius to meet public maximum permitted exposure in the worst case (30° elevation) scan angle.

Transmit Power (W)	Ground Screen Extension	Standoff Radius (m)
500	No	106
700	No	124
500	Yes	79
700	Yes	96