

### Description of Horizontal Antenna Element Construction.

The horizontal antenna elements are 3 conductor layer circuit boards. The material is Duroid 5880 with ½ ounce copper. The overall dimensions of the horizontal element circuit board are shown in Figure 1.

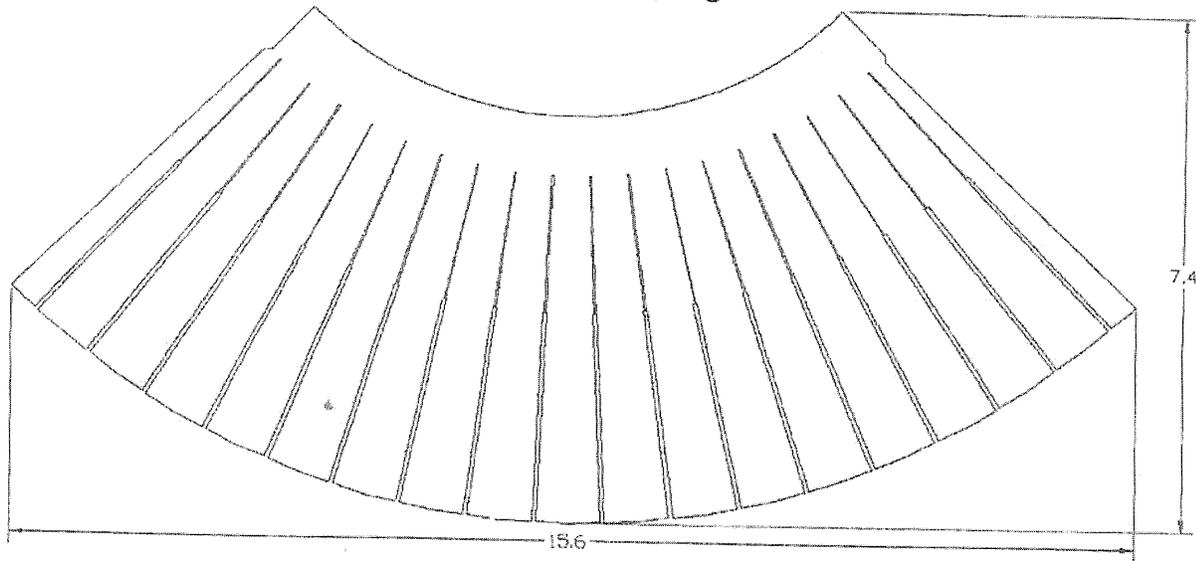


Figure 1 Overall Dimensions, in inches, of horizontal element circuit board.

The bottom conductor layer and bottom dielectric layers are shown in Figure 2.

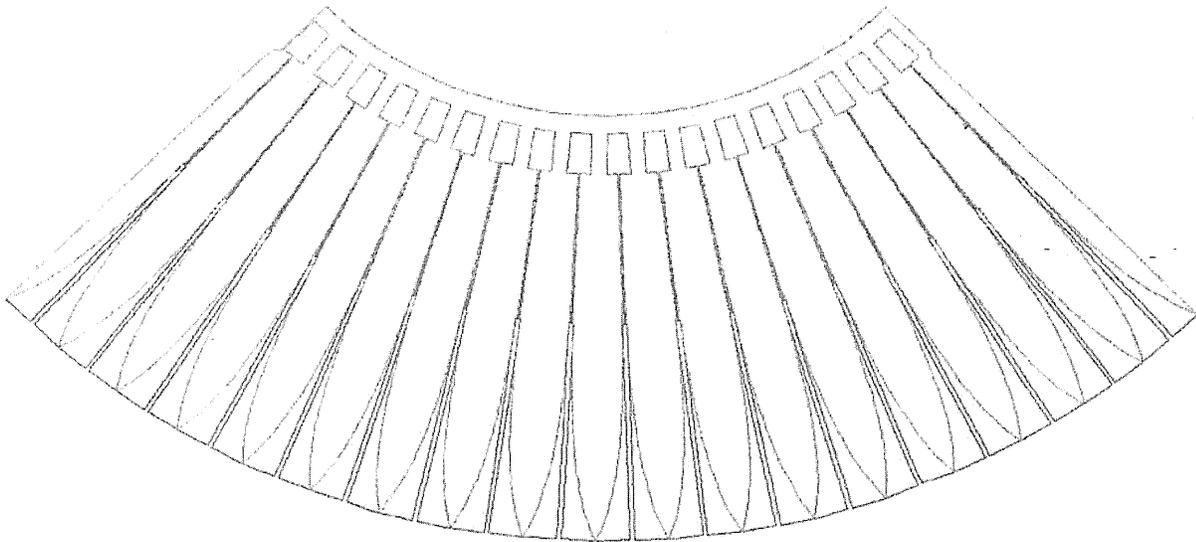
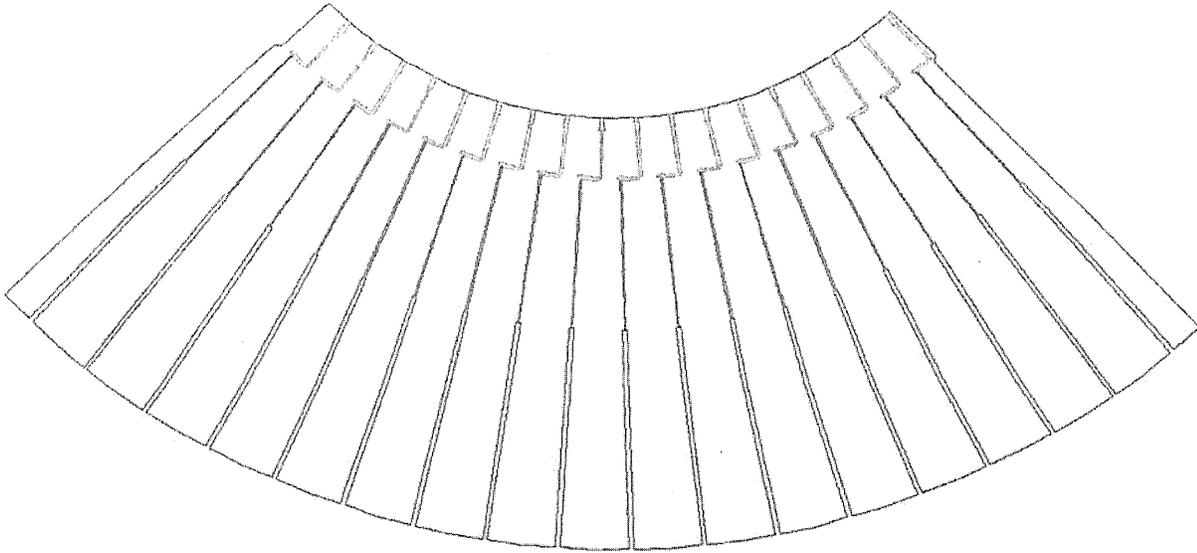


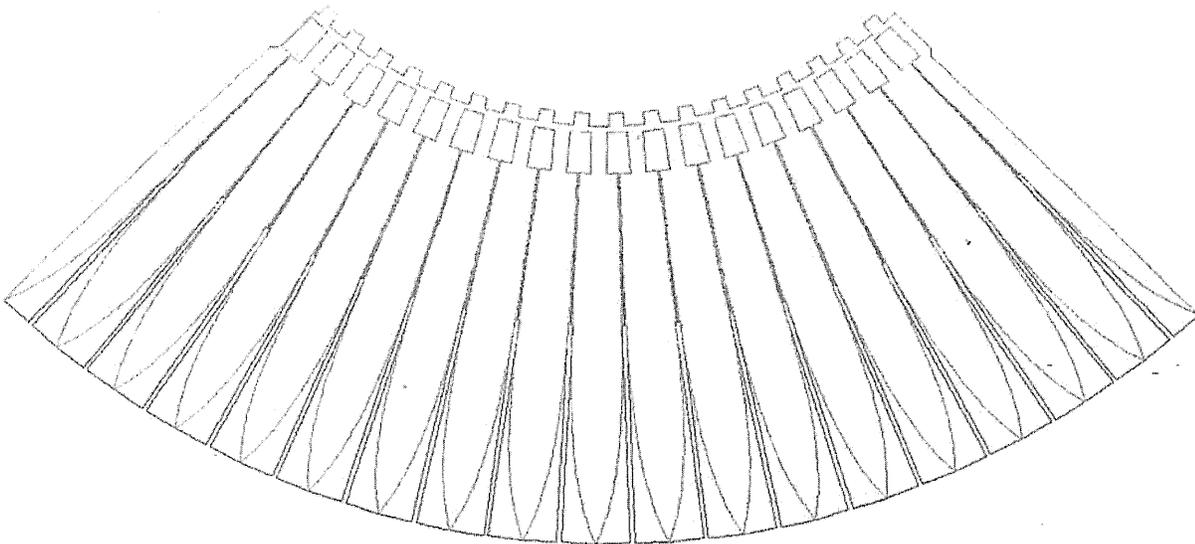
Figure 2 Black Outline: Bottom Dielectric; Blue Outline: Bottom conductor layer.

The center conductor layer is etched on the near side of the bottom dielectric layer as shown in Figure 3.



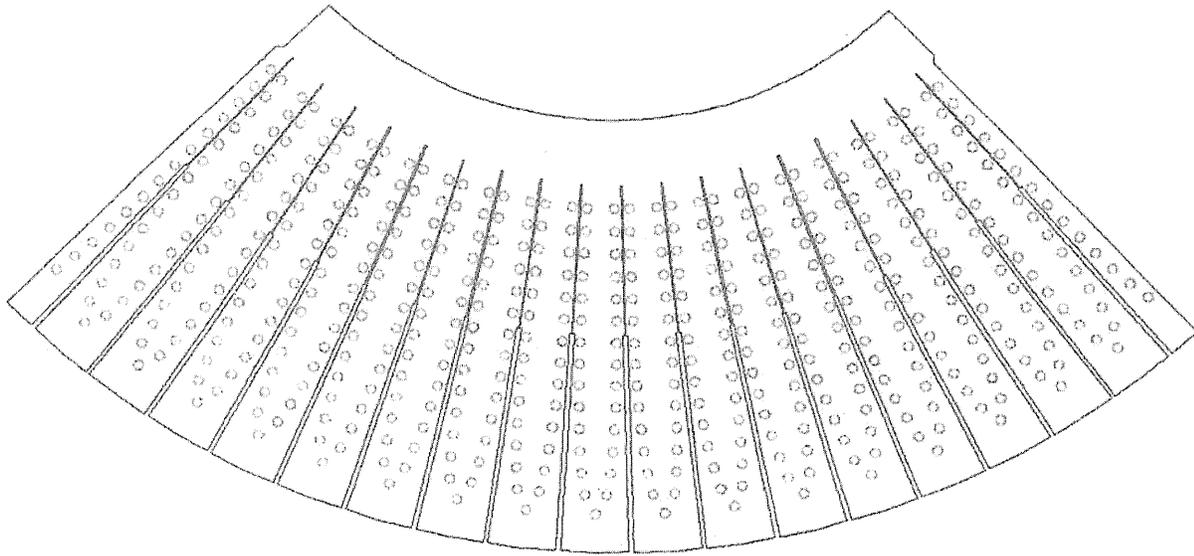
**Figure 3 Black Outline: Bottom Dielectric; Red Outline: Center conductor layer.**

The top conductor and top dielectric layers are shown in Figure 4. Bond the top and bottom dielectric layers using an index matching bond film 2 mils thick or less.



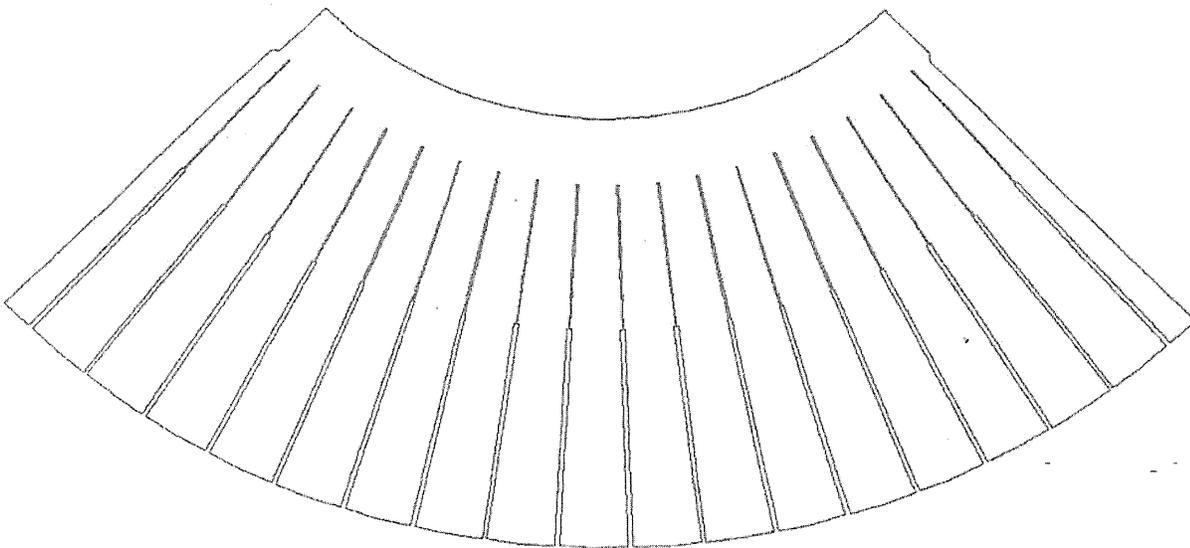
**Figure 4 Black Outline: Top Dielectric; Blue Outline: Top conductor layer.**

There are 521 plated through holes 125 mils in diameter between the bottom and top dielectric layers as shown in Figure 5.



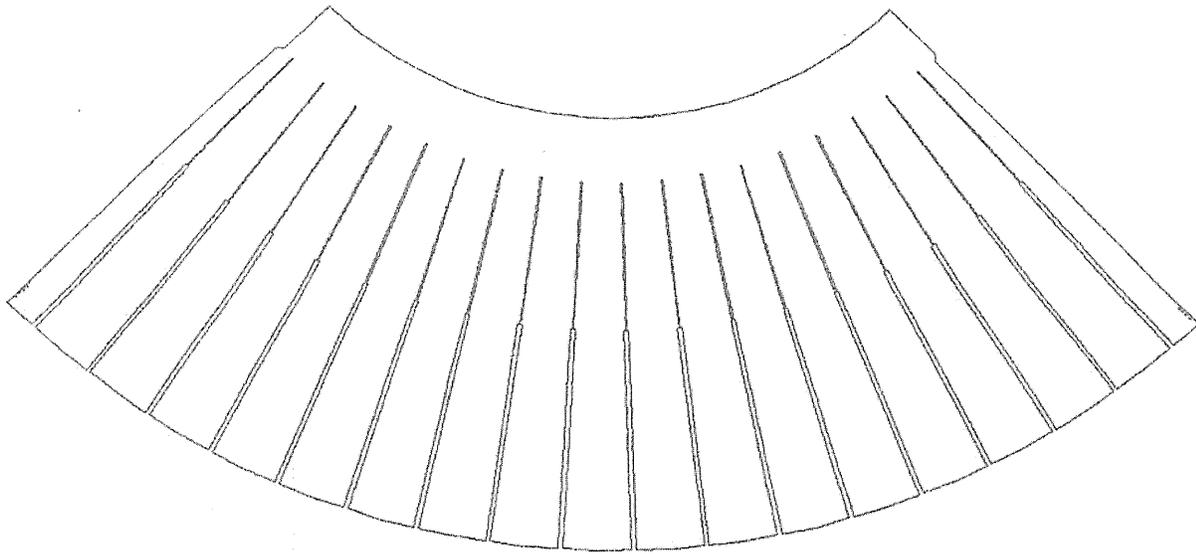
**Figure 5** Black Outline: Bottom Dielectric; Green Circles: 125 mil plated through holes.

There are 666 plated through holes 25 mils in diameter between the bottom and top conductor layers as shown in Figure 6. It is OK to allow the holes to close up during the plating process.



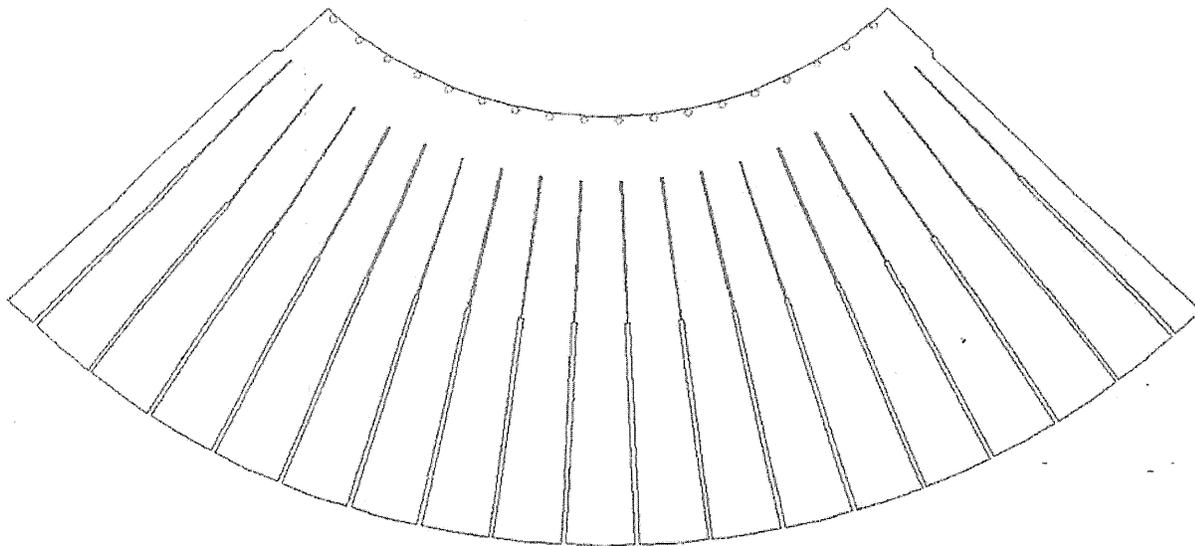
**Figure 6** Black Outline: Bottom Dielectric; Orange Circles: 25 mil plated through holes.

There are 8 plated through holes 35 mils in diameter between the bottom and top conductor layers as shown in Figure 7. These holes should be kept open after the plating through process.



**Figure 7** Black Outline: Bottom Dielectric; Magenta Circles: 35 mil plated through holes.

There are 18 plain through holes 89 mils in diameter through all dielectric and conductor layers as shown in . These holes may be plated through if it simplifies construction.



**Figure 8** Figure 6 Black Outline: Bottom Dielectric; Red Circles: 89 mil plain holes.

A rendered picture of the horizontal element board is shown in Figure 9. Note the narrow slots cut into the board. At the outside edge, the slots are 58 mils wide, but closer in the slots step down to 18 mils width.

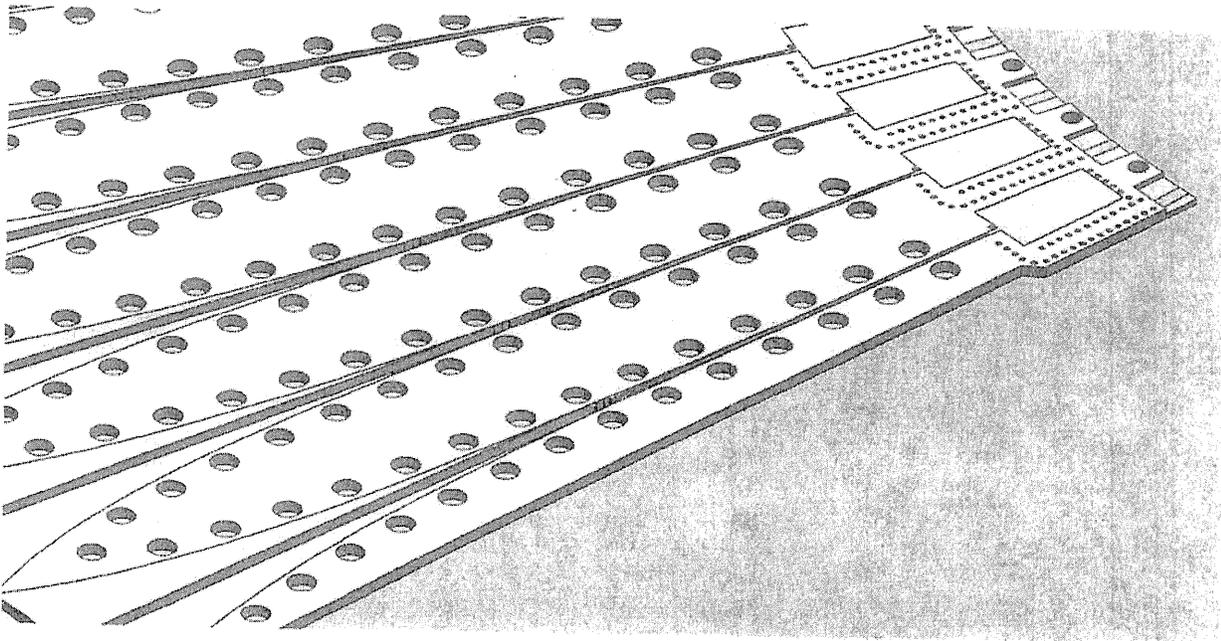


Figure 9 Oblique view of finished horizontal element board showing slots.

### Description of Vertical Element Construction.

The material is Duroid 5880, 25 mils thick, with  $\frac{1}{2}$  ounce copper on each side. There are 3 metal layers and two dielectric layers. The overall dimension of the vertical element circuit board are shown in Figure 10.

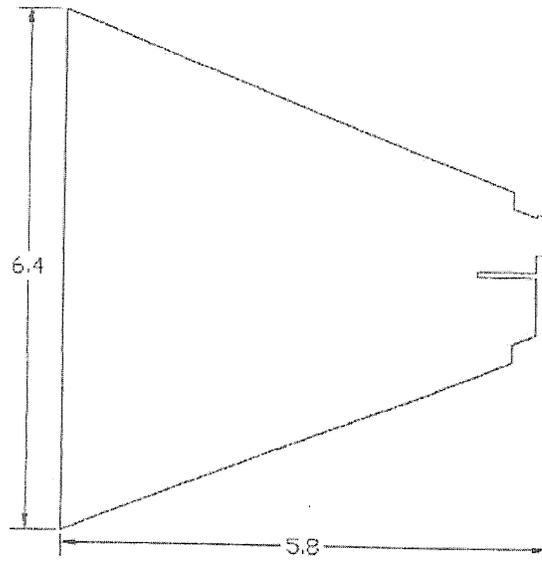


Figure 10 Overall dimensions, in inches, of the vertical antenna element circuit board.

The bottom metal layer and bottom dielectric layer are shown in Figure 11

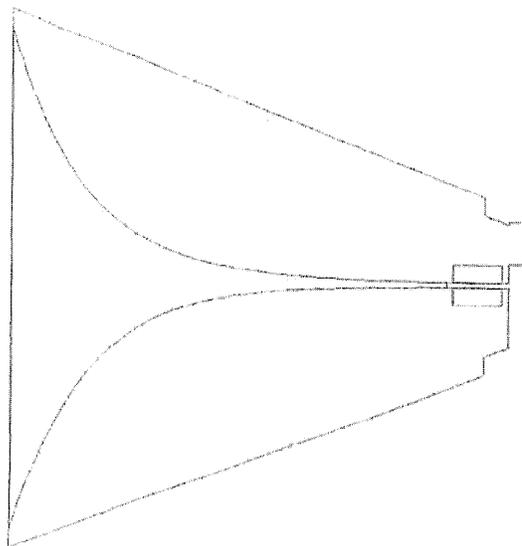


Figure 11 Black Outline: Bottom Dielectric; Blue Outline: Bottom Conductor[s].

There is a recess routed in the bottom dielectric on the far side as shown in Figure 12.

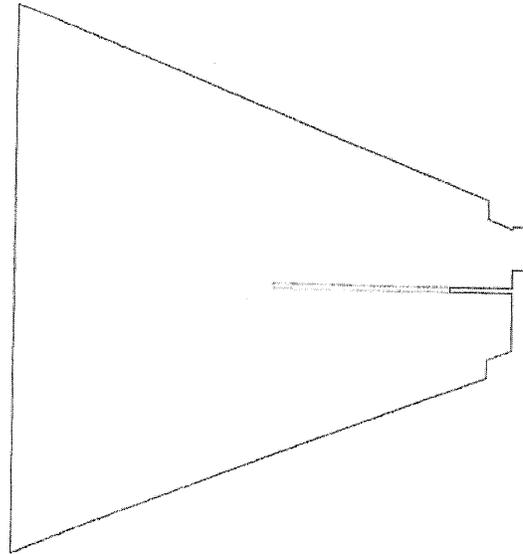


Figure 12 Black Outline: Bottom Dielectric; Green Outline: Bottom Recess.

The feed line for the vertical antenna element is etched in the near side conductors on the bottom dielectric layer as shown in Figure 13.

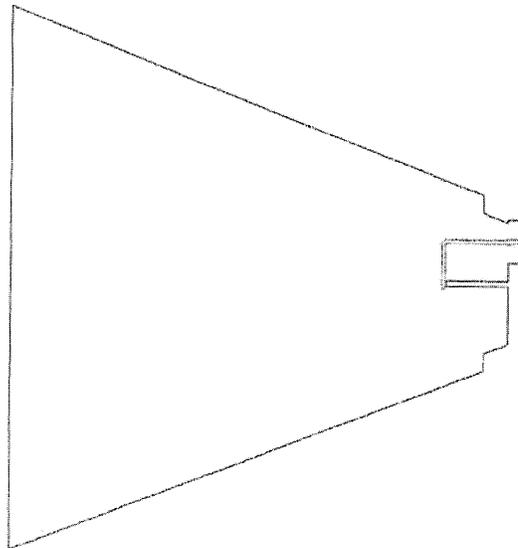


Figure 13 Black: Bottom Dielectric; Red: center conductor layer.

The top dielectric and top conductor layers are shown in Figure 14. Bond the top and bottom dielectric layers using an index matching bond film 2 mils thick or less.

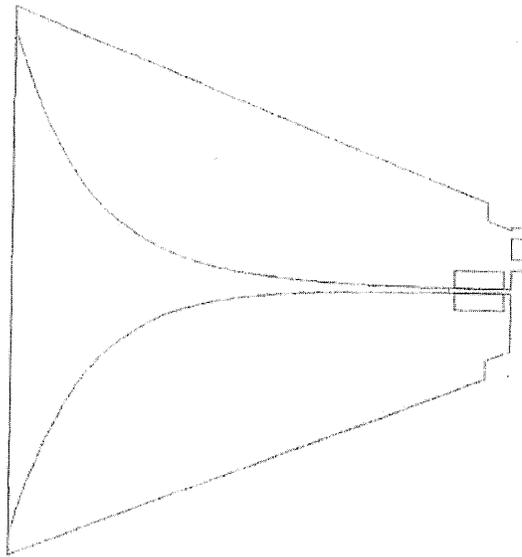


Figure 14 Black outline: Top Dielectric; Blue outline: Top Conductor[s].

A recess is cut in the top dielectric. The outline is shown in Figure 15.

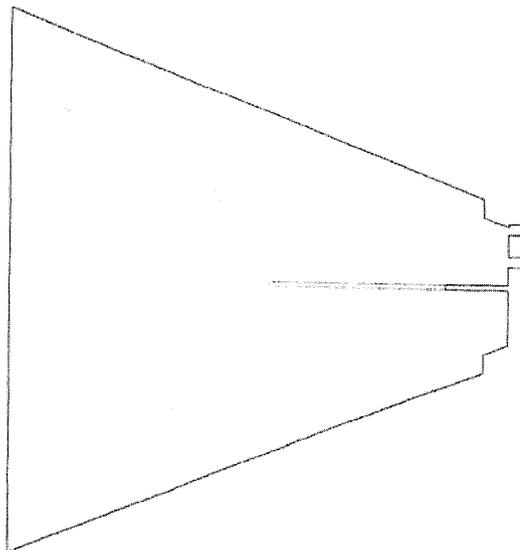


Figure 15 Black Outline: Top Dielectric; Light Blue Outline: top recess.

The recesses cut in the top and bottom dielectric layers are the same. They should be the same depth, and that depth should be chosen so that total thickness of the substrate material left between the recesses is 20 to 22 mils. Figure 16 shows an oblique view of the top side recess.

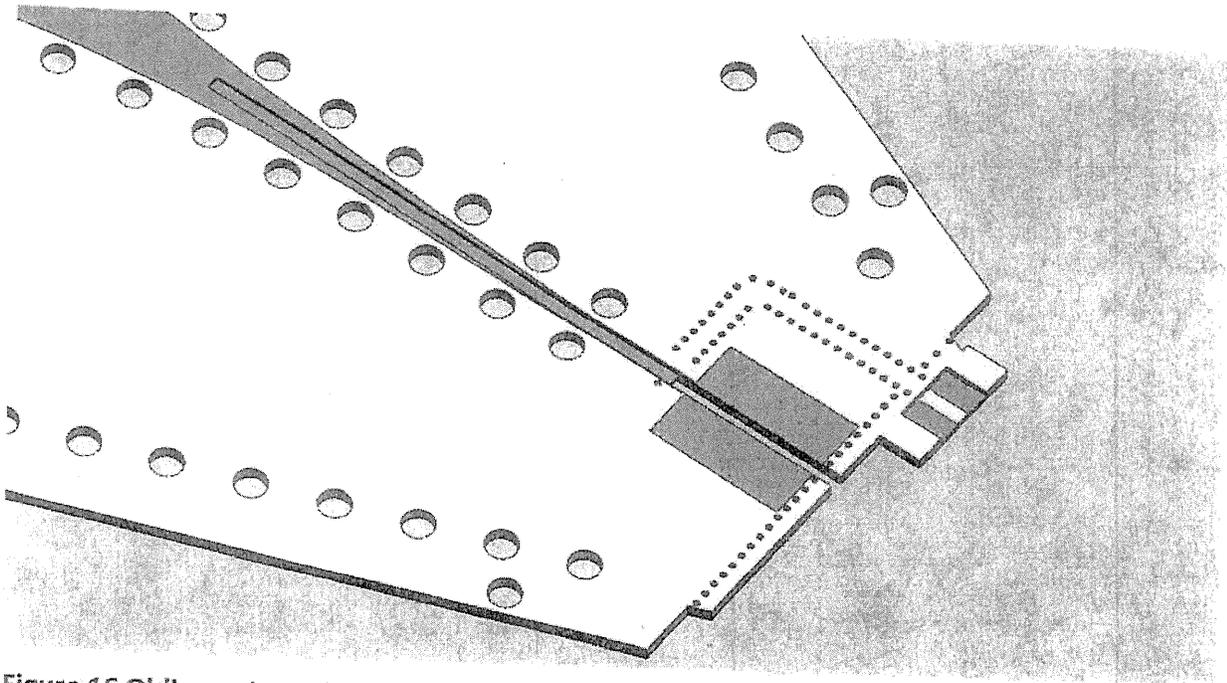


Figure 16 Oblique view of top recess.

The recess in Figure 16 and the one on the back side need to be deep enough to fit into the slot in the horizontal circuit board shown in Figure 9. The two boards together are shown in Figure 15.

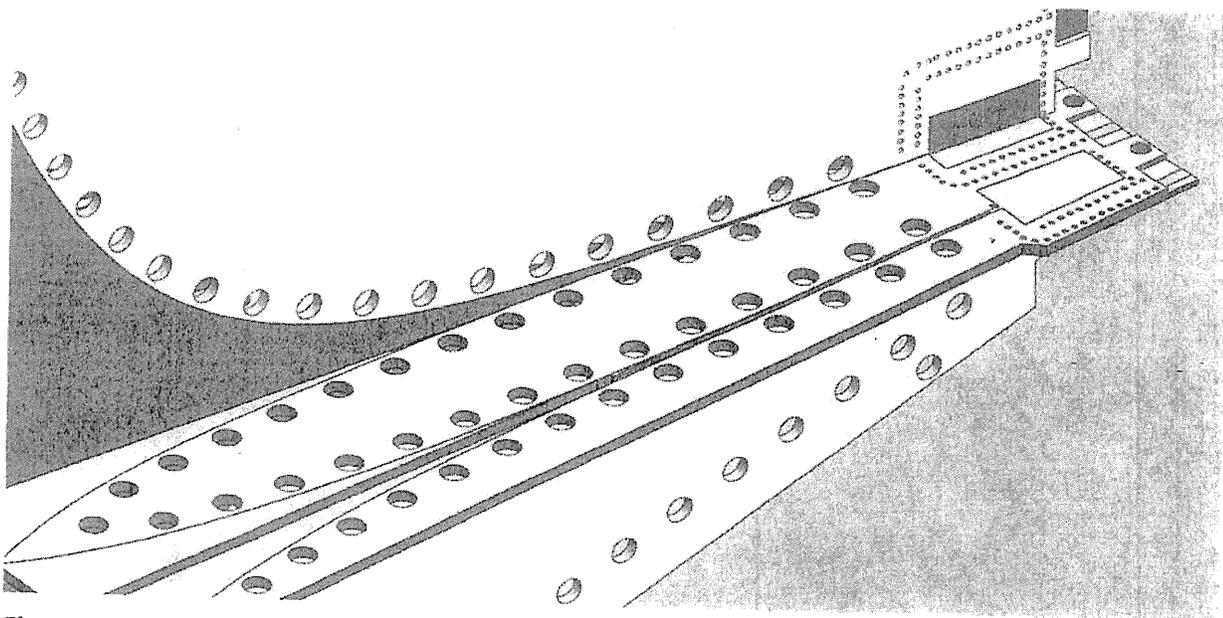


Figure 17 Horizontal and vertical elements interlace together egg-crate style.

Figure 16 shows plated through holes which have not been specified yet and probably would be constructed before the recess. There are two sizes of plated through holes. The large plated through holes are 125 mils in diameter and are shown in Figure 18.

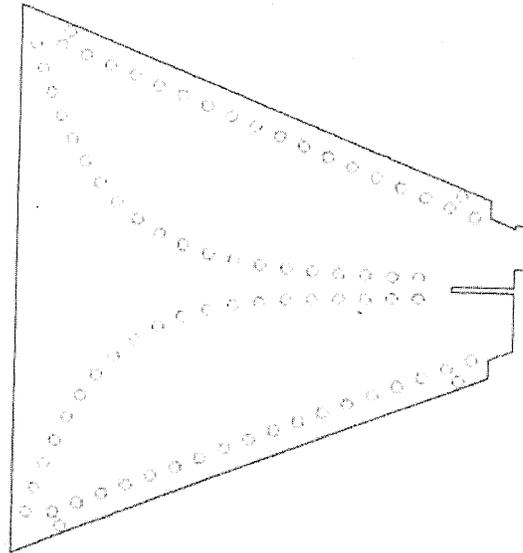


Figure 18 Black Outline: Bottom Dielectric Layer; Green circles: 125 mil plated through holes.

The small plated through holes are 25 mils in diameter and are shown in Figure 19. The small plated through holes may be allowed to fill in during the plating process.

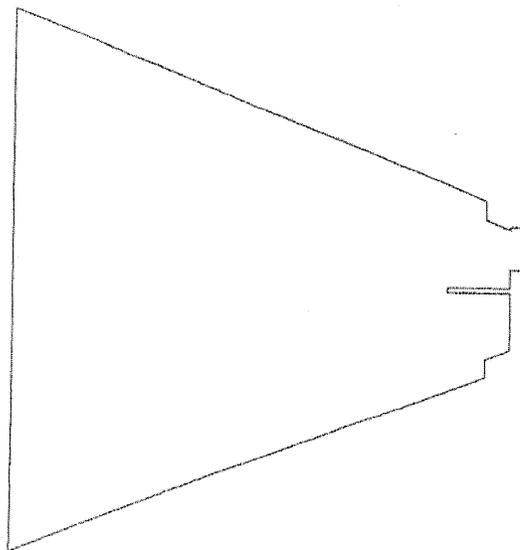


Figure 19 Black Outline: Bottom Dielectric layer; Orange circles: 25 mil plated through holes.

The final plating on the exposed conductors is immersion tin.

4 horizontal element boards and 72 vertical element boards are required.

NRL will provide the gerber files for the horizontal and vertical boards.