Signal Drill Size: Is it Critical?

Yes. Consider using 6 mil drills for wide bandwidths

Signal Drill Size: Equation 3 explains why signal drill size is critical in RF launch optimization.

$$f_{cutoff} = \frac{11.8}{\sqrt{\varepsilon_R}\,\pi\left(\frac{D_d + D_c}{2}\right)} \quad \text{(Eqn. 3)}$$

Eqn. 3. shows that there is a certain frequency (f_{cutoff}) above which the signal can propagate in more than one mode simultaneously and that the f_{cutoff} is inversely proportional to the signal drill size and inner GND ring size (this can be converted to a function of signal drill size using Eqn. 1). **For good signal quality, f_{cutoff} should be above the maximum frequency of interest. This means the signal drill size has to be quite small as we push toward 100 GHz bandwidths!**

Table 1 below helps visualize why the drill size must be so small.

- The cutoff frequency [in GHz] – calculated using Eqn. 3 – as a function of drill diameter and E_r
- Key takeaway: think of using 6 mil drills and dielectrics with $E_r < 3$ for really wide bandwidths

Drill diameter [mil]	Er						
	2.50	2.75	3.00	3.25	3.50	3.75	4.00
3	201	176	156	138	124	111	100
4	151	132	117	104	93	83	75
5	120	106	93	83	74	67	60
6	100	88	78	69	62	56	50
7	86	76	67	59	53	48	43
8	75	66	58	52	46	42	38

Table 1: Drill diameter needed for high bandwidth launches