7.3.4.2 Example C-Band Designs (Continued)

A major drawback is the degradation in angle tracking ability with the decreased aperture. It was calculated that only 0.5° rms angle tracking accuracy could be achieved (at a 1 S update rate) with the example design.

Combining SSPAs with a 1 m aperture and realistic pulse compression capabilities probably would not give good enough range tracking ability either, so a heavier HPA technology would be required.

For these reasons, higher frequency designs were also examined.

7.3.4.3 Example Ka-Band Designs

Holding the aperture constant, the peak power required from a radar falls with increasing frequency, everything else being equal.

A number of different HPA technologies are available at millimeter wavelengths [Ref. 59, 60, 61]. For these example system designs, coaxial magnetrons [Ref. 62] were chosen. Magnetrons are self oscillators and hence do not require an input from a low power transmitter chain. Operating in that mode, magnetrons are completely incoherent from pulse-to-pulse, i.e. there is no deterministic relationship between the phases of successive pulses. In general, magnetrons are chosen where small size and portability are more important than stability and high mean power [Ref.48].

Such devices have been identified in the catalogues [63 & 64] with peak powers varying from 20 kW to 135 kW at Ka-band.

The standard waveguide for this band of frequencies is WR28. Calculations indicate that in vacuum, WR28 will experience multipaction at about 6 kW peak power at 35 GHz. Hence, to realistically use such devices implies pressurizing the entire high power RF circuitry or filling with dielectric which would probably induce too high a loss.