

Power Density Calculation

	G (dB)	D (m)	A (m ²)	P (W)	S _{surface} (w/m ²)	R _{nf} (m)	S _{nf} (w/m ²)	R _{ff} (m)	S _{t max} (w/m ²)	S _{ff} (w/m ²)
1' Panel	23.5	0.4310	0.0929	0.316	13.6097	0.8978	8.6686	2.1547	5.1884	1.2132
2' Panel	28.0	0.8620	0.3715	0.316	3.4024	3.5912	2.1671	8.6188	2.1671	0.2137
2' parabolic	28.5	0.6096	0.2917	0.316	4.3330	1.7961	4.3330	4.3107	4.3330	0.9585
4' parabolic	34.0	1.2192	1.1669	0.316	1.0832	7.1845	1.0832	17.2428	1.0832	0.2126
6' parabolic	38.0	1.8288	2.6254	0.316	0.4814	16.1651	0.4814	38.7963	0.4814	0.1055
8' parabolic	40.0	2.4384	4.6674	0.316	0.2708	28.7380	0.2708	68.9712	0.2708	0.0529

Where:

G: antenna gain

D: antenna diameter in meters, for panel antenna, $D = 1.414 \times$ the side length of the antenna

C: physical area of the aperture antenna

P: radio output power, $P_{\max} = 0.316$ W

A: physical area of the aperture antenna

S_{surface} : maximum power density at the antenna surface, $S_{\text{surface}} = 4P/A$

R_{nf} : extent of near field, $R_{\text{nf}} = D^2/4\lambda$, where λ is wavelength, at 5.8GHz, $\lambda=0.052\text{m}$

S_{nf} : maximum near field power density, $S_{\text{nf}} = 16\eta P/\pi D^2$; for worst case situation, η is assumed to be 1

R_{ff} : distance to beginning of far field; $R_{\text{ff}} = 0.6D^2/\lambda$

$S_{\text{t max}}$: maximum power density in the transition region; $S_{\text{t max}} = S_{\text{nf}} \cdot R_{\text{nf}}/R_{\text{min}}$; where $R_{\text{min}} = \min(1.5\text{m}, R_{\text{nf}})$

S_{ff} : far field power density (on axis); $S_{\text{ff}} = PG/4\pi R^2$

Note: Power density beyond 1.5m from the center of antenna must be within 10W/m^2 or 1mW/cm^2