Power Density Calculation

	G (dBi)	h (m)	Width (m)	A (m^2)	OD (m)	θ (3dB BW Az$^{o)}$	P (W)	$S_{surface}$ (w/m2)	$R_{nf\ (m)}$	S_{nf} (w/m^2)	S_{nfmax} (w/m^2)	$R_{ff\ (m)}$	S_{ff}(w/m^2)
Omni 7.5	7.5	0.276			0.0254		0.066	2.9983	0.7760	2.9983	2.9983	0.7760	0.0491
Omni 9	9.0	0.5			0.0400		0.066	1.0510	1.9858	1.0510	1.0510	1.9858	0.0106
Omni 12	12.0	0.83			0.0560		0.066	0.4522	6.5773	0.4522	0.4522	6.5773	0.0019
SEC-5V/H-90-17	17.0	0.65	0.216	0.1404		90	0.066	1.8803	4.0721	0.0040	0.0108	4.0721	0.0159
SEC-5V/H-60-18	18.0	0.65	0.216	0.1404		60	0.066	1.8803	3.4177	0.0047	0.0108	3.4177	0.0284

Where:

G: antenna gain

h: the height of the antenna

A: physical area of the aperture antenna

P: radio output power, P_{max} = 0.066 W

$S_{surface}$: maximum power density at the antenna surface, $S_{surface}$ = 4P/A, with omni antenna, $S_{surface}$=P/(2x3.14xODxh)

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

With omni antenna, Rnf is where $S_{nf}=S_{ff}$; Rnf=Gh/2, where G is the antenna gain

With sector antenna, R_{nf} is where $S_{nf}=S_{ff,}$ $R_nf=\theta hG/720$

$S_{nf\ max}$: maximum near field power density,

For panel and parabolic antennas, Snf = 16ηP/πD2 (D is the antenna diameter); for worst case situation, η is assmumed to be 1

For omni and sector antenna, $S_{nf}=180P/(\theta\pi h\ R_{nf})$

R_{ff}: distance to beginning of far field; with omni and sector antenna, R_{ff} starts at the point where $S_{nf}=S_{ff}$

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

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

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