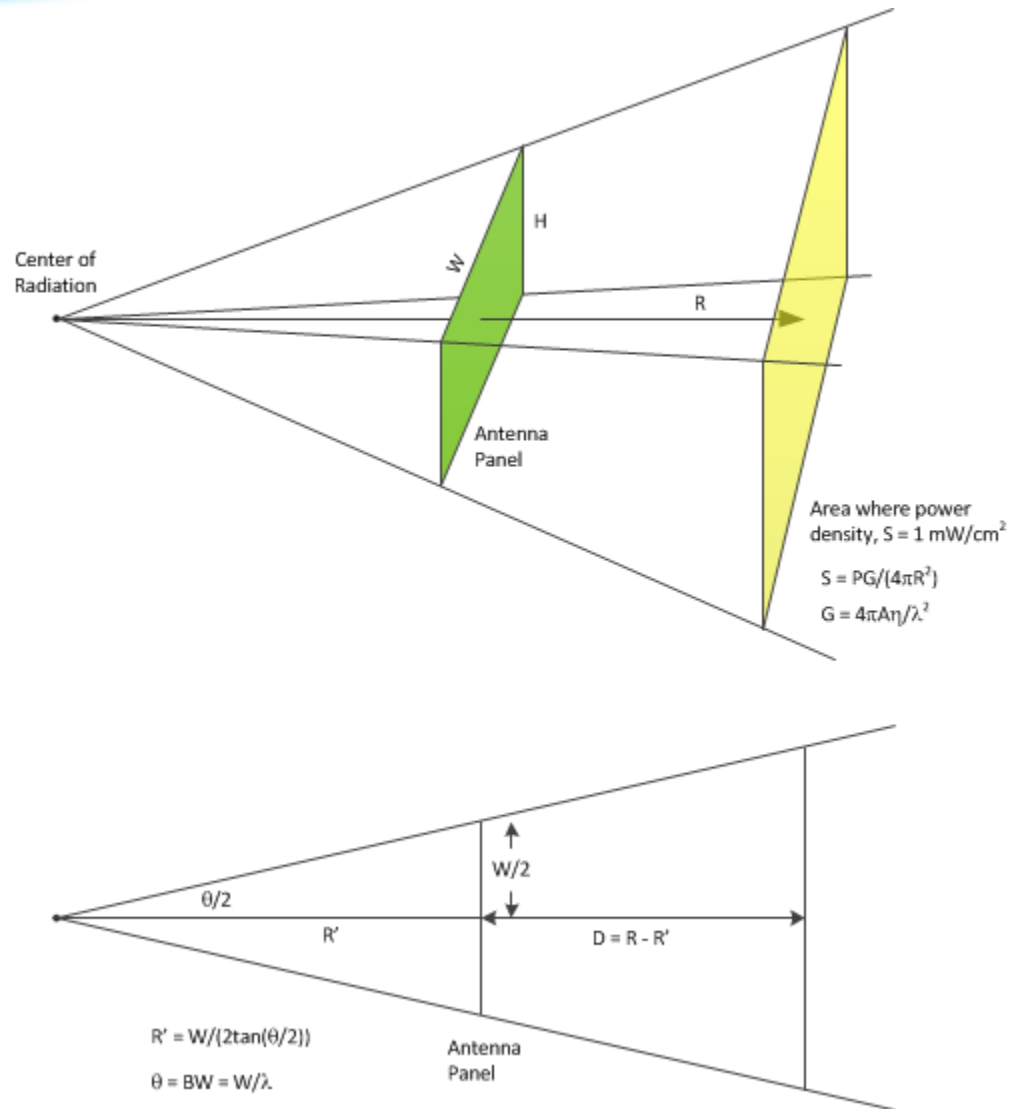# Power Density Calculations using Center of Radiation Model

- **The drawings show the antenna geometry and equations for our panel antenna with dimensions W and H.**
- **The center of radiation is behind the antenna and radiates with azimuth and elevation beamwidths.**
- **The power density on the antenna surface and any plane in front of the antenna is computed with this model.**
- **R' is the distance from the center of radiation to the antenna panel.**
- **R is the distance from the center of radiation to the plane where S = 1mW/cm².**

Center of Radiation

H

W

R

Antenna Panel

Area where power density, $S = 1 \text{ mW/cm}^2$

$S = PG/(4\pi R^2)$

$G = 4\pi A\eta/\lambda^2$

$\theta/2$

R'

W/2

$D = R - R'$

$R' = W/(2\tan(\theta/2))$

$\theta = BW = W/\lambda$

Antenna Panel

TARANA
WIRELESS

Calculations

Power per PA in Tx Mode	23.6	dBm	0.23	W
Max Duty Cycle	0.67		-1.76	dB
Number of PAs	16		12.04	dB
Total Average Tx Power	33.88	dBm	2.44	W
Antenna Width	18.2	inches		
Antenna Height	10.5	inches		
Antenna Area	191.1	in^2		
Frequency	2.60E+09	Hz		
c (speed of light)	1.18E+10	in/sec		
lamda (wavelength)	4.54	inches	11.54	cm
Antenna Directivity	116.37	numeric	20.66	dBi
Antenna Losses	2	dB		
Antenna Gain	18.66	dBi	73.42	numeric
S (limit for general population)	1	mW/cm^2	0.006452	W/in^2
R	47.04	inches			R is distance from center of radiation to plane with power density S
Antenna Azimuth BW	14.30	deg		
Antenna Elevation BW	24.79	deg		
R' derived from width	72.54	inches		
R' derived from height	23.89	inches		
R' average (geometric mean)	41.63	inches			R' is distance from center of radiation to antenna face (R' is behind antenna)
Dist from face of Antenna	5.41	inches	13.75	cm	Distance from face of antenna to plane with power density S = 1mW/cm^2
S' with antenna loss	0.00806804	W/in^2	1.25	mW/cm^2	Power density on surface of antenna

TARANA
WIRELESS

Result of Calculations

- The maximum power density on the surface of the antenna panel is 1.25 mW/cm^2.
- The distance from the antenna panel to the plane where the power density is 1mW/cm^2 is 13.75 cm, or 5.4 inches.

TARANA
WIRELESS