Calculation of power density

![Note icon] Note

The following calculation is based on the ANSI IEEE C95.1-1991 method, as that provides a worst case analysis. Details of the assessment to EN50383:2002 can be provided, if required.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P.G}{4\pi d^2}$$

Where:	Is:
S	power density in W/m^2
P	maximum average transmit power capability of the radio, in W
G	total Tx gain as a factor, converted from dB
d	distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P.G}{4\pi.S}}$$

Calculated distances and power compliance margins

Table 84 shows calculated minimum separation distances, recommended distances and resulting margins for each frequency band and antenna combination. These are conservative distances that include compliance margins. At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

Explanation of terms used in Table 84:

Tx burst – maximum average transmit power in burst (Watt)

P – maximum average transmit power capability of the radio (Watt)

G – total transmit gain as a factor, converted from dB

S – power density (W/m^2)

d – minimum distance from point source (meters)

R – recommended distances (meters)

C – compliance factor

Table 84 Power compliance margins, 5 GHz

Band	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)	C
5 GHz	Integrated, 13 dBi	0.199	20	10	0.18	.4	51
5 GHz	Connectorized, 15 dBi	0.199	31.6	10	0.22	.4	32

Table 85 Power compliance margins, 2.4 GHz, AP

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)	C
PMP	20 MHz	Connectorized, 8 dBi Omni	0.631	6.3	10	0.18	0.4	50.5
PMP	40 MHz	Connectorized, 8 dBi Omni	0.631	6.3	10	0.18	0.4	50.5
PMP	20 MHz	Connectorized, 17 dBi Sector	0.079	50.1	10	0.18	0.4	50.5
PMP	40 MHz	Connectorized, 17 dBi Sector	0.032	50.1	10	0.11	0.3	71.3
PTP	20 MHz	Connectorized, 25 dBi Dish	0.003	316.2	10	0.08	0.2	63.2
PTP	40 MHz	Connectorized, 25 dBi Dish	0.003	316.2	10	0.08	0.2	63.2

Table 86 Power compliance margins, 2.4 GHz, STA

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)	C
PMP	20 MHz	Connectorized, 8 dBi Omni	0.631	6.3	10	0.18	0.4	50.5
PMP	40 MHz	Integrated, 12 dBi Patch	0.251	15.8	10	0.18	0.4	50.5
PMP	20 MHz	Connectorized, 17 dBi Sector	0.079	50.1	10	0.18	0.4	50.5
PMP	40 MHz	Connectorized, 19 dBi Panel	0.050	79.4	10	0.18	0.4	50.5
PMP	20 MHz	Connectorized, 25 dBi Dish	0.010	316.2	10	0.16	0.4	63.5
PMP	40 MHz	Connectorized, 8 dBi Omni	0.100	6.3	10	0.07	0.2	79.6
PMP	20 MHz	Integrated, 12 dBi Patch	0.050	15.8	10	0.08	0.2	63.2
PMP	40 MHz	Connectorized, 17 dBi Sector	0.025	50.1	10	0.10	0.2	39.9
PMP	20 MHz	Connectorized, 19 dBi Panel	0.020	79.4	10	0.11	0.3	71.3
PMP	40 MHz	Connectorized, 25 dBi Dish	0.006	316.2	10	0.13	0.3	56.7
PTP	20 MHz	Integrated, 12 dBi Patch	0.398	15.8	10	0.22	0.4	31.9

PTP	40 MHz	Connectorized, 17 dBi Sector	0.158	50.1	10	0.25	0.5	39.5
PTP	20 MHz	Connectorized, 19 dBi Panel	0.050	79.4	10	0.18	0.4	50.5
PTP	40 MHz	Connectorized, 25 dBi Dish	0.010	316.2	10	0.16	0.4	63.5
PTP	20 MHz	Integrated, 12 dBi Patch	0.050	15.8	10	0.08	0.2	63.2
PTP	40 MHz	Connectorized, 17 dBi Sector	0.025	50.1	10	0.10	0.2	39.9
PTP	20 MHz	Connectorized, 19 dBi Panel	0.020	79.4	10	0.11	0.3	71.3
PTP	40 MHz	Connectorized, 25 dBi Dish	0.006	316.2	10	0.13	0.3	56.7

 Note

Gain of antenna in dBi = 10*log(G).

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

At 2.4 GHz, 5.4 GHz and EU 5.8 GHz, the products are generally limited to a fixed EIRP which can be achieved with the Integrated Antenna. The calculations above assume that the maximum EIRP allowed by the regulations is being transmitted.

 Note

If there are no EIRP limits in the country of deployment, use the distance calculations for FCC 5.8 GHz for all frequency bands.