

Device installation report for FCC U-NII-1 band (5.15- 5.25GHz) compliance

The Federal Communications Commission (FCC) established new rules for the 5.15 – 5.25 GHz U-NII-1 band in the Report and Order FCC-14-30A1 are effective from 2nd June, 2014. With the help of professional installation, all the Proxim devices can be configured to comply with the power requirements set in the rules. For an angle of elevation which is above 30 degrees, the maximum EIRP limit should be set to 125mW (21 dBm). The compliance can be achieved through proper selection of antenna, angle of installation, and Tx power control to provide reasonable protection from harmful interference to the users, authorized devices, and co-channel NGSO/MSS operations.

- Proxim devices such as BSUs (Base Station Units)/ SUs (Subscriber Units) are installed by professional installers to work in fixed outdoor configurations.
- These devices are in general mounted on a tower, roof, or at a place above the street level; therefore, it implies that all Proxim devices whether they have an external antenna or an integrated antenna support vertical alignment to achieve downward tilt.
- All devices support TPC (Transmit Power Control) configuration with a range of (0 – 21dB*) that allows professional installers to lower the power when necessary.

Note: * Transmit power control varies with the product type and specific modulation.

The antenna/devices located at different altitudes should be tilted at the correct angle to transmit/receive the signals effectively; thus, it optimizes the transmission and reception of signals between the devices in the wireless network. The Figure 1.1 below shows the antenna tilt and its importance when the successive devices are at different elevations above the ground.

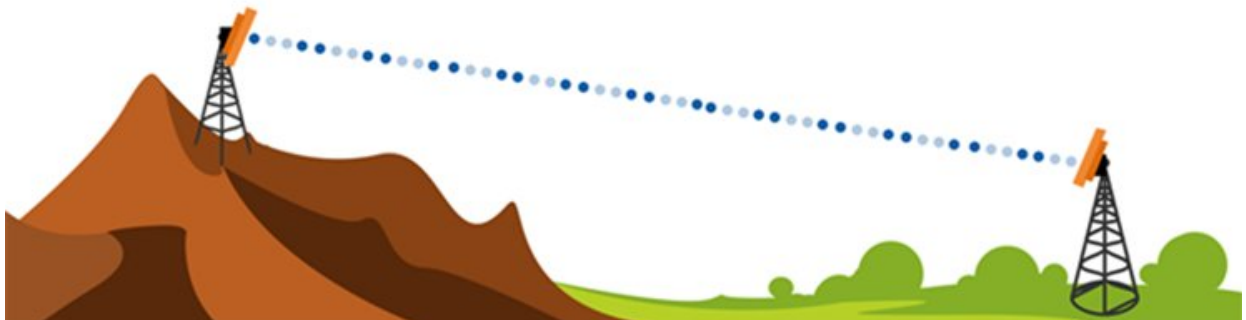


Fig 1.1 Typical installation showing device/antenna tilt angle

Consider the sample antenna patterns of a Proxim device in Azimuthal and Elevation planes of a Horizontal polarized antenna. As per the regulatory domain, there are no limitations to the Azimuthal plane with respect to EIRP, but the Elevation plane has a limit specific to EIRP above 30° as 21 dBm. To comply with this specification, Proxim products have an option to control the transmit power based on the installation tilt angle and radiation pattern of the antenna.

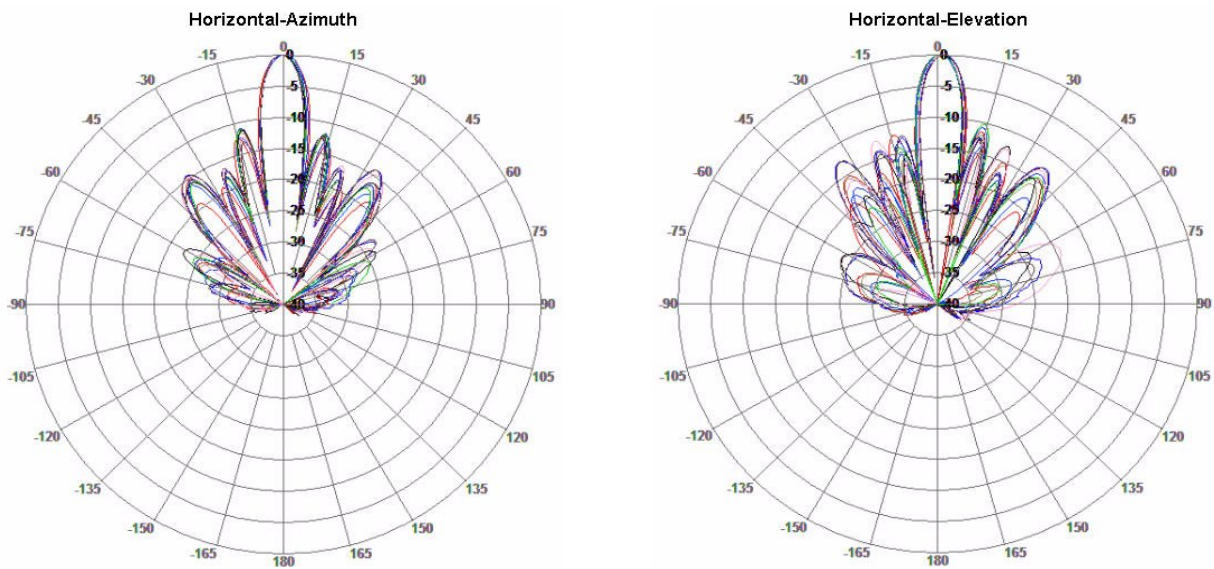


Fig 1.2 Antenna Radiation Patterns for Azimuthal and Horizontal Planes

The formula used for the calculation of Transmit power is as below:

$$\text{Transmit Power} = \text{EIRP} - G_{(30-\theta)} - \text{MIMO Gain}$$

- **EIRP** - Equivalent Isotropically Radiated Power
- **$G_{(30-\theta)}$** - Antenna gain at $(30-\theta)$ in the elevation plain
- **MIMO Gain** - Gain for Multi Input Multiple output products, For 2x2 MIMO Gain is 3dB, 3X3 MIMO

Gain is 4.8dB and MIMO Gain is 0 for single polarized antenna

Let us consider an example of radiation pattern and calculate the Transmit power at three different tilt angles of the antenna.

Case 1:

$\theta = 0^{\circ}$ (No antenna tilt)

The antenna gain for the $\theta = 0^{\circ}$ is shown in the **Figure 1.3**

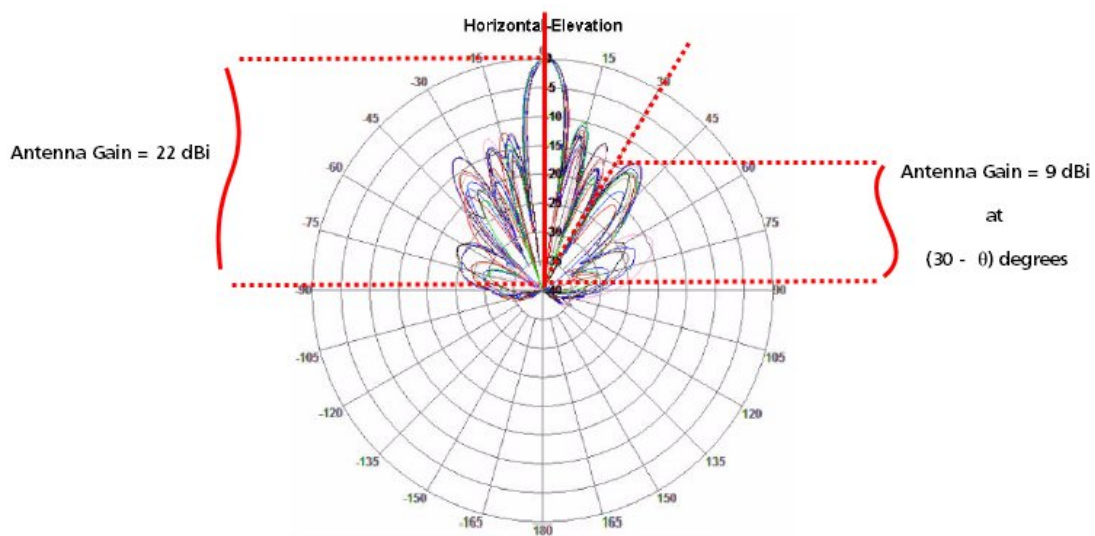


Fig 1.3 Antenna gain at $(30 - \theta) = 30^{\circ}$

$$\begin{aligned} \text{Transmit Power} &= \text{EIRP} - G_{(30-\theta)} - \text{MIMO Gain} \text{ (MIMO Gain is 0 for single polarized antenna)} \\ &= 21 - 9 - 0 = 12 \text{ dBm} \end{aligned}$$

Case 2:

$\theta = 15^\circ$ (antenna tilted upward)

The antenna gain for the $\theta = 15^\circ$ is shown in the **Figure 1.4**

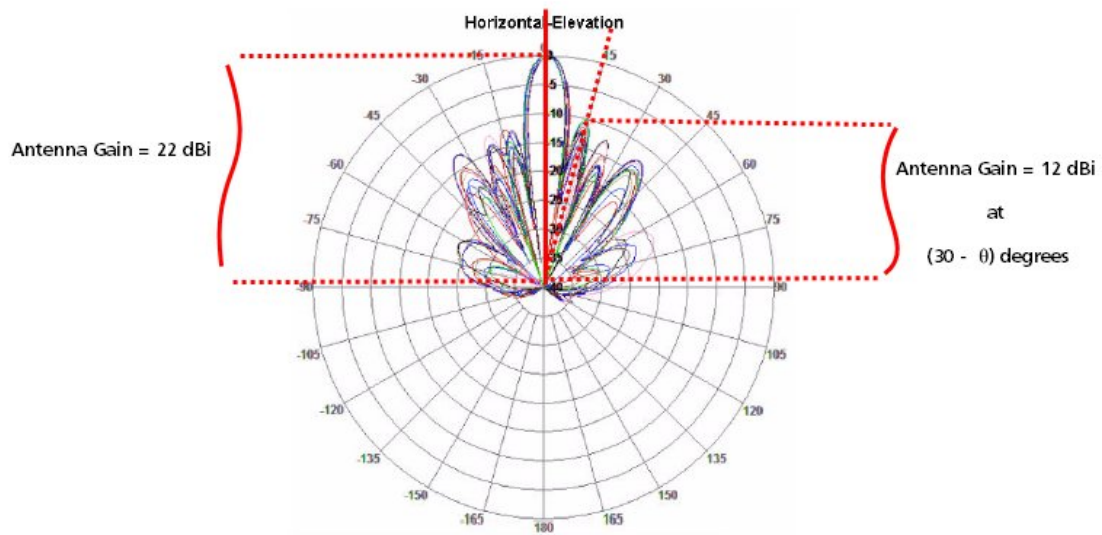


Fig 1.4 Antenna gain at $(30 - \theta) = 15^\circ$

$$\begin{aligned} \text{Transmit Power} &= \text{EIRP} - G_{(30 - \theta)} - \text{MIMO Gain} \\ &= 21 - 12 - 0 = 9 \text{ dBm} \end{aligned}$$

Case 3:

$\theta = -15^\circ$ (antenna tilted downward)

The antenna gain for the $\theta = -15^\circ$ is shown in the **Figure 1.5**

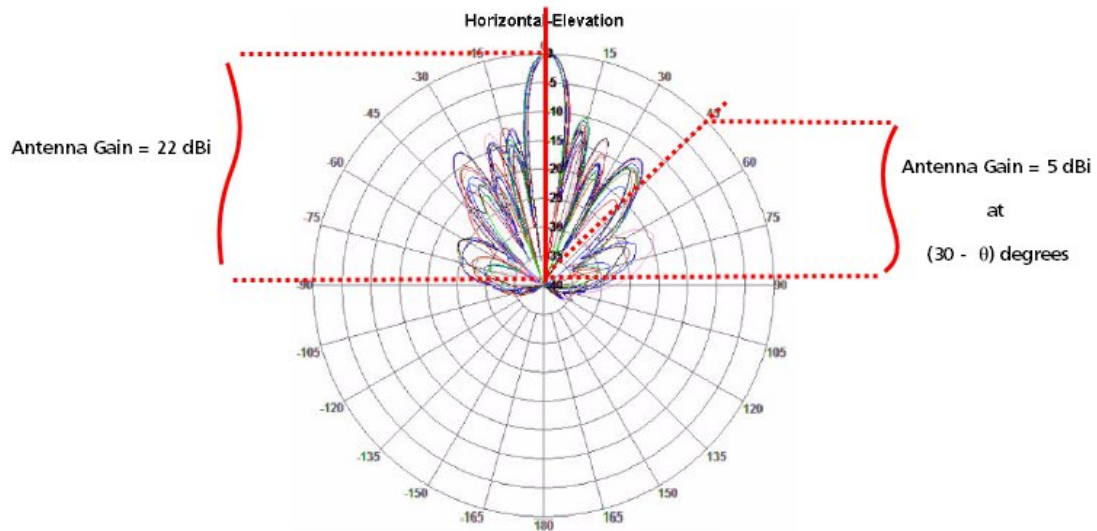


Fig 1.5 Antenna gain at $(30 - \theta) = 45^\circ$

Transmit Power = EIRP - $G_{(30 - \theta)}$ - MIMO Gain

= 21 - 5 - 0 = 16 dBm

With the built in capabilities, both the integrated and connectorized antenna versions of Proxim's **Tsunami 8xxx/8xx** products are in compliance with the EIRP rules above 30°. To assist the installers in complying with the rules, the down tilt angle and Tx power settings of Proxim devices are presented in the tables given below:

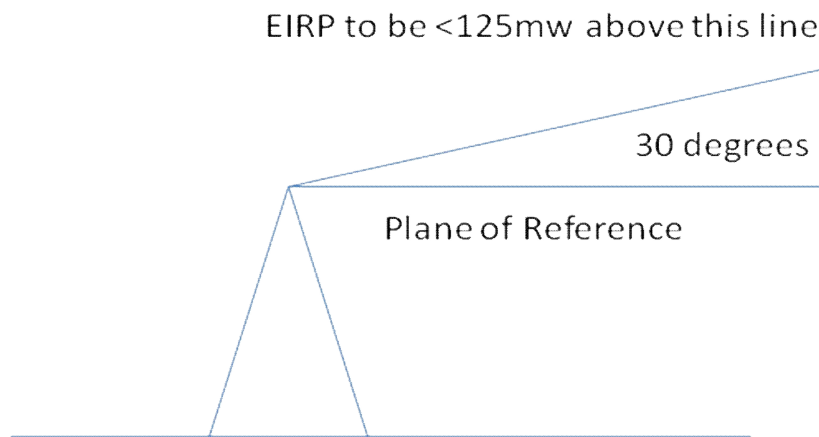


Figure 1: Graphical representation of Antenna Tilt angle

**1. Products – MP-8150-SUR; MP-8250-SUR; MP-8250-BS1
Antenna Gain – 23 dBi**

Tilt Angle	Horizontal Gain @ 30° (dBi)	Vertical Gain @ 30° (dBi)	Allowed Transmit Power per chain (dBm)	EIRP @ 30° (dBm)	Remarks
0	11	7	7	21	
-10	11	7	7	21	
-20	4	5	13	21	
-30	4	4	14	21	
10	11	9	7	21	
20	13	10	5	21	
30	23	23	-5	21	Not recommended

Table 1: Tilt Angles and corresponding EIRP values

Note:

- -10 degree indicates that the antenna is tilted downwards
- 10 degree indicates that the antenna is tilted upwards

2. Product – MP-8150-SUR-100
Antenna Gain – 21 dBi

Tilt Angle	Horizontal Gain @ 30° (dBi)	Vertical Gain @ 30° (dBi)	Allowed Transmit Power per chain (dBm)	EIRP @ 30° (dBm)	Remarks
0	8	8	10	21	
-10	8	7	10	21	
-20	7	7	11	21	
-30	7	7	11	21	
10	8	10	8	21	
20	14	11	4	21	
30	21	21	-3	21	Not recommended

Table 2: Tilt Angles and corresponding EIRP values

3. Products – MP-825-CPE-50, MP-825-CPE-100, MP-825-SUR-50+, MP-825-BS3-100
Antenna Gain – 16 dBi

Tilt Angle	Horizontal Gain @ 30° (dBi)	Vertical Gain @ 30° (dBi)	Allowed Transmit Power per chain (dBm)	EIRP @ 30° (dBm)	Remarks
0	7	3	11	21	
-10	3	0	15	21	
-20	3	0	15	21	
-30	3	-4	15	21	
10	8	3	10	21	
20	16	16	2	21	
30	16	16	2	21	

Table 3: Tilt Angles and corresponding EIRP values

4. Product – MP-8250-BS9
Antenna Gain – 16 dBi

Tilt Angle	Horizontal Gain @ 30° (dBi)	Vertical Gain @ 30° (dBi)	Allowed Transmit Power per chain (dBm)	EIRP @ 30° (dBm)	Remarks
0	0	-2	18	21	
-10	-1	-2	19	21	
-20	-1	-2	19	21	
-30	-1	-4	19	21	
10	-1	-2	19	21	
20	3	6	12	21	
30	16	16	2	21	

Table 4: Tilt Angles and corresponding EIRP values

Point-to Multipoint Devices

- i. Following is the list of integrated variant products. They are compliant to FCC 5.2G EIRP limits when the Allowed Transmit Power is according to the tilt angle of the installed devices as mentioned in the tables **above**.

Devices with Integrated Antenna
MP-8150-SUR; MP-8250-SUR; MP-8250-BS1
MP-8150-SUR-100
MP-825-CPE-50, MP-825-CPE-100, MP-825-SUR-50+, MP-825-BS3-100
MP-8250-BS9

- ii. Following is the list of Connectorized variant products. They are compliant to FCC 5.2G EIRP limits when installed by considering the following parameters:
1. Gain of the external antenna
 2. Antenna cable loss
 3. Radiation pattern



The transmit power control of connectorized devices depends on the type of the antenna, its tilt angle and therefore requires professional installation.

Devices with Connectorized Antenna
MP-8100-BSU
MP-8200-BSU
MP-820-BSU-100
MP-820-SUA-50+
MP-825-SUR-50+
MP-8150-SUR-100
MP-8100-SUA
MP-8200-SUA
MP-8250-SUR

Point-to - Point Devices

- iii. Following is the list of Point-to-Point variant products. According to the FCC set of rules the EIRP limit for point-to-point devices is 53 dBm (30dBm transmit power+23dBi antenna gain). The Integrated variant of devices are already in compliance with the set EIRP limit, but the connectorized devices have to be adjusted by a Professional installer to comply with the EIRP limit.

Quick Bridge Devices /Point-to-Point Devices Connectorized Version
QB-8100-EPA
QB-8200-EPA

Quick Bridge Devices /Point-to-Point Devices Integrated Version
QB-8150-EPR
QB-8150-LNK-100
QB-8150-LNK-12
QB-8150-LNK-50
QB-8151-EPR
QB-8200-EPR
QB-825-EPR-50
QB-825-EPR-50+