SkyPilot SkyAccess/SkyConnector U-NII Band Transmit Power Control (TPC)

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Overview

SkyAccess DualBand and SkyConnector units (hereafter referred to generically as SkyConnectors) operating in the U-NII bands of 5.25-5.35 GHz and 5.47-5.725 GHz employ a Transmit Power Control (TPC) mechanism which reduces the EIRP below the 30 dBm mean value by 6 dB to comply with the FCC's part 15 requirements. This document provides a description of the method and algorithms utilized to satisfy the TPC requirements.

Functionality

The SkyPilot system implements several separate functions that provide the TPC functionality regulators have specified.

SkyPilot's system implements four (4) separate mechanisms that match the intent of TPC.

1. Use of directional antennas: with directional antennas, each a narrow 45° beam, the SkyPilot system efficiently utilizes the spectrum and helps avoid interference. Since the SkyPilot system does not meaningless "spray" the spectrum in all 360°, the spectrum can be reused by other unlicensed users.

2. Antenna switching: the directional antennas on the SkyPilot system are not used all the time. Instead, these antennas are used periodically through the use of an antenna switching system. The SkyPilot system transmits packets only on one specific 45° at a time and then switches to transmit on another 45° sector in the next time frame. By switching directional antennas, the SkyPilot system furthers the ability to reuse the unlicensed frequency.

3. Configurable output power control: the SkyPilot system allows administrators to select amongst several different power levels. This gives control to the operators in the unlicensed spectrum to be “good neighbors” when other users are operating in the same spectrum.

4. Automatic modulation control: the SkyPilot system operates under an automatic modulation rate control (from 6 to 54 Mbps) algorithm that automatically selects the highest, most reliable rate possible on continuous basis. This process ensures the optimal transmission type for all conditions and minimizes the time to transmit a given data packet while also ensuring that the minimum the power level is utilized.

    a. Link Optimization: SkyPilot’s link optimization algorithm initially tests all mod rates (6 to 54 Mbps) and determines which rate satisfies our link criteria based upon received signal power levels and packet error rates. The highest modulation rates are reduced by 6 dB to ensure that the shortest transmit times and minimum power levels have been attempted before moving to more robust modulation rates and higher power levels in more challenging environments.

    b. Dynamic Modulation Control: SkyPilot’s Dynamic Modulation Control continuously monitors link statistics to ensure maximum link efficiency from both a modulation rate and power level. If the link can support a higher order modulation rate and lower transmit power level, SkyPilot’s algorithm will increase the modulation rate so as to increase channel efficiency. Hysterisis is employed to prevent the system from switching back and forth between modulation rates too quickly and thereby increasing system instability.

The combination of these four mechanisms demonstrates the intent of SkyPilot Networks to meet the intent of Transmit Power Control regulations.