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Project Number
38683

Project Title
The Effect of Ultraviolet Radiation on the Signal Strength of Amateur Radio Satellite Transmissions

Abstract

Objectives/Goals
This experiment served to implement the various satellite-tracking techniques acquired through the Irvine CubeSat Program and to verify the claims by several ham-radio operators that radio signals are stronger during nighttime where there is considerably less UV interference.

Methods/Materials
Thirty satellite passes were tracked using the High Definition Software-Defined Radio (HDSDR), a Yagi arrow antenna, and a dongle at different times of the day under varying levels of UV radiation. The amount of UV radiation that the satellites were exposed to was manipulated changing the time of day in which the satellites were tracked. The waterfall displays generated from the HDSDR during each satellite capture was documented, and these displays were quantified using a number scale that ranged from 0 to 10. This scale was created based on the amount of pixel coverage for each of the colors on the waterfall displays.

Results
The signal intensity of the satellites decreased as UV presence increased, which verified the claims made by several ham-radio operators that radio signals tended to be stronger during nighttime where there is considerably less UV interference. The R-squared value for the for this data confirmed that there was a correlation between the amount of UV exposure and the signal intensity.

Conclusions/Discussion
The hypothesis was supported by the data because the signal intensity of the satellites decreased as UV exposure increased. This trend most likely resulted because greater levels of UV radiation contributed to greater levels of signal interference. The R-squared value for the trendline for this data was 0.685, which confirmed that there was a clear correlation between the amount of UV exposure and the signal intensity. These findings can be used to develop a software that could calculate a future satellite's orbit to optimize the satellite's power usage when transmitting radio signals.

Summary Statement
Thirty satellites were tracked using a software-defined radio under varying UV levels, and their waterfall displays were used to determine their signal intensities.

Help Received
Our group designed and performed the experiments ourselves. The skills that were necessary for satellite tracking were acquired through the CubeSat Program.