A CDM Wireless White Paper

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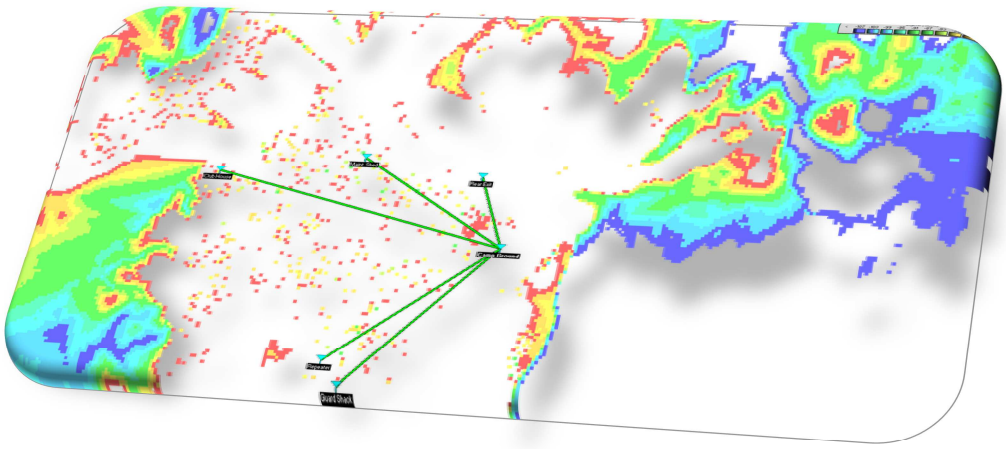

Remote Property Owner's Association

A Case Study

Deploying a Challenging Wireless Network

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Introduction

CDM first engaged with our integration partner to develop a wireless data network for the remote POA project because they were unable to find a wireless solution for this challenging installation.

During the early planning stages we discussed wireless bandwidth options for the environment that we considered to be most likely to lead to a successful deployment.

Given the nature of the terrain in that particular area of the state we recommended an NLOS (Near Line of Sight) deployment utilizing the 900 MHz spectrum.

This is a study of how, in this particular situation, our original assessment and designs led to necessary adjustments in order to derive a working system.

Problem Statement

As a matter of practice and policy, CDM Wireless endeavors to create a detailed wireless study of the environment utilizing cutting edge wireless simulation software, on site visits and relying on past experience of our wireless engineers. All of these practices were followed with the Remote POA project. However, discrepancies between specified design specs and implementation led to a system performance metrics that were below expectations and did not match up with our simulated results.

While CDM continued to work with our integration partner to reach a suitable design specification, we continued to evaluate the results from the system to better understand what would cause the issues noticed during the Phase I project stage.
After studying the wireless simulation data and the terrain analysis, we were unable to

come to a conclusive understanding of the problem. CDM was able to schedule another site visit at the request of our integration partner to take another look at the actual environment. The difference this time is that CDM staff would be onsite for installation diagnosis and would get a bird's eye view of the project from the onsite boom lift.

With this perspective it was still not apparent to either CDM staff or our integration partner's staff as to which ridgeline the remote ends were located behind. It was decided to place two lifts one at each end of the link and identify the lifts from each end. This did not prove to be as successful as we had hoped as the dense forest prevented us from seeing the lifts among the trees.

Our next solution was to fire a safety flare from the access point end and aim the antennas at the origin point.

The flare strategy worked very well and we were able to instantly identify the aiming location for the station devices.

However, when we attempted to do the same for the AP, from the station locations, we were surprised to discover a ridgeline in between the actual location of the station and the AP.

We had seen the ridgeline previously from the boom lifts and mistook it for the ridge on which the station had been installed.

The major surprise for us was that the ridgeline did not appear in the GIS data or the SRTM data that was used to perform the modeling. This was troubling because we were already using the highest resolution data available to us for the area.

Much to our surprise, we learned that the terrain heights in the data had been normalized to an average within 90m. The ridgeline was close enough to the height of the grade at the station end that the information was averaged as the same height.

This averaging of data created a problem for the modeling software because the variables for the ridgeline were not included in any modeling algorithms.

This may not have been an issue in other regions of the country, but the long leaf pine trees that are prevalent in the Carolina Piedmont can grow quite tall. And it was this dense forestry that was causing the issue with near line of sight conditions.

The visual cues we received from the boom lift seemed to match what we were seeing in the software but the surrounding terrain was deceiving. It wasn't until we fired a flare from the station end that we were able to notice the difference between the two elevations as our flare seemed to rise from the middle of the forest floor rather than the slope we originally aimed for. The optical illusion was caused by the unexpected ridgeline as our station site was just slightly lower on the rise than the top of the ridgeline in front of it. The tops of the Carolina long leaf pines contributed to the effect by creating a leveling visual effect.

This new and unexpected height change set us on a mission to determine new antenna mounting heights and new radio hardware that could take advantage of the new poles that were going to be set for the project.

The new heights would be sufficient to clear the surrounding foliage and leave enough Fresnel clearance for a 2.4 GHz or 5.8 GHz wireless system to function as a backhaul. This would allow an increase in overall bandwidth on the system enabling it to carry more IP video sources.

Final Solution

The final solution for the project included new mounting facilities and an average mounting height of 80' above the grade. This height was required in order to provide sufficient Fresnel clearance for the 5.8 GHz backhauls and the 900 MHz client connections.

Converting the system to 5.8 GHz was required to provide enough bandwidth for the surveillance system that had been installed.

Benefits

The tangible benefits of the changeover to 5.8 GHz and the elevation changes in mounting position are increased bandwidth and system availability.

However, here at CDM we believe the most notable outcome of this installation was the level of support given to the customer. It is our intention with every job we take on to provide the customer with a lasting solution and to continue providing our best effort to support the installation moving forward.

Summary

In summary, we have a couple of take away bullet points from this installation.

- Had the initial specifications from the factory been followed, the 900 MHz system should have functioned as designed. However, a number of variables contributed to requirements that were well beyond the capabilities of such a limited bandwidth system.

- Provide every customer with specific and detailed recommendations for mounting the wireless equipment. Once the customer has the information, be sure to consult with them in following the guidelines.

- Keep our customers up to date and informed about useful tools and mobile applications that can streamline the installation process.

- A viable solution won't always be obvious right from the start as in the case of 'invisible' ridgelines. Geographical models and wireless propagation studies can be valuable, but it often helps to have eyes on the ground, especially in such challenging environments.