



Pericle Communications Company

August 26, 2013

Via email: drowe@larimer.org

Mr. David Rowe

Larimer County Tech. Comm.

2501 Midpoint Dr.

Fort Collins, CO 80525

Subject: Report on Drive Test Survey in Poudre River Canyon

Dear Mr. Rowe:

This letter serves as our report on the recent drive test survey conducted by our firm in the Poudre River Canyon (Colorado Highway 14). The purpose of this drive test survey was to measure the performance of a prospective new antenna site and to compare it to the performance of Middle Bald Mountain, first measured in October 2009.

Approach. The locations of Middle Bald Mountain and the alternative tower site are shown in Figure 1. For convenience, we will call the alternative tower site “Site A.” It is roughly 3,000’ northwest of Middle Bald Mountain and about 11,000’ above mean sea level (AMSL).

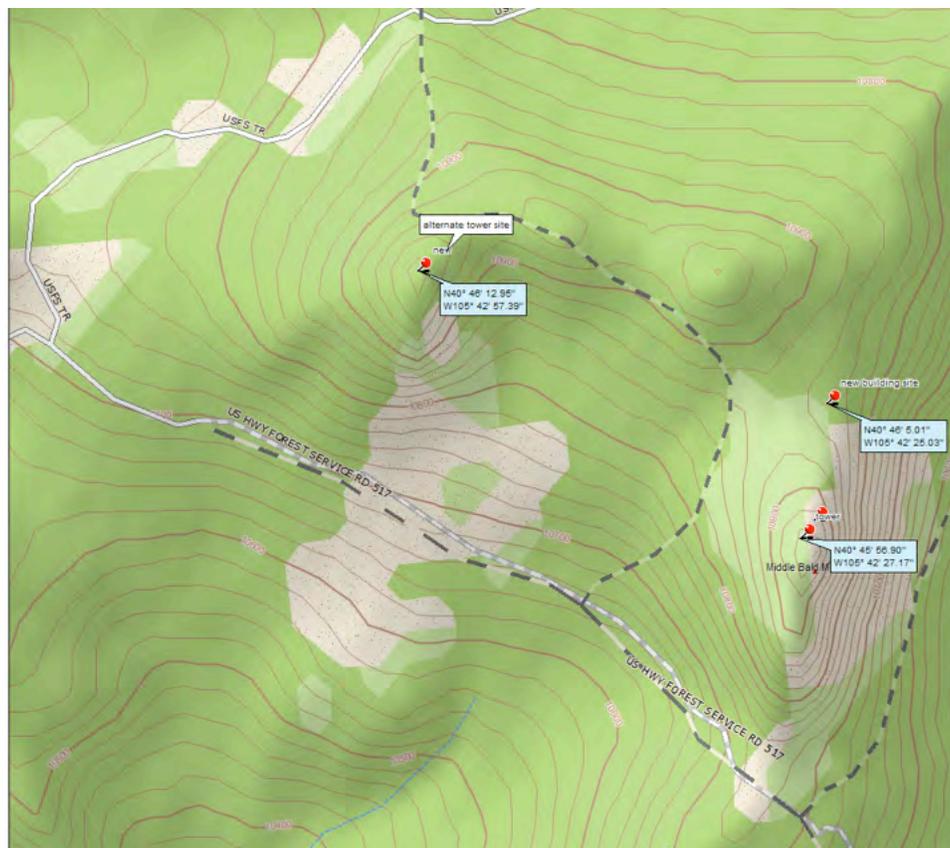


Figure 1 - Location of Alternative Tower Site (“Site A”)

Middle Bald is comparable, at 10,950' AMSL. Pericle deployed a Quantar 800 MHz repeater to Site A on July 30, 2013 and erected a 20' high antenna mast at coordinates 40-46-10.9 N, 105-42-56.8 W, just slightly south of the high point of the peak. This location was selected to avoid any screening by foliage. It affords a clear view of to the south as shown in Figure 2.



Figure 2 - Panoramic view looking South from Site A

The transmitter was tuned to 852.5125 MHz, a mutual aid channel, and the transmitter output power was set to create the same test ERP as the 2009 test from Middle Bald Mountain (70.6 Watts). The same 3 dBd omni antenna was used for both surveys. A typical operational ERP for either site is 159 Watts, about 3.5 dB stronger than the test ERP.



Figure 3 - Antenna Mast

After the test transmitter and antenna mast were erected and verified to be working properly, Mike Ray (*Pericle*) collected measurements using a full size pickup truck with similar height to the vehicle used in 2009. An identical 3 dBi mag mount receive antenna and coaxial cable were used with the identical Grayson computer-controlled test receiver and GPS receiver. The Grayson test receiver collects one subsample measurement every 10 milliseconds. Custom software linearly averages at least 50 subsamples over at least 40 wavelengths distance to create one sample. This approach ensures an accurate estimate of the mean signal strength in the presence of Rayleigh-distributed multipath fading. Samples were stored to disk for later processing.

Results. To remove spacial bias, the collected samples were gridded to a uniform grid. After gridding to 100 meter square tiles using a nearest-sample interpolation and computing the intersection between the 2009 and 2013 data sets, there are 1,833 tiles between Cameron Pass and the Colorado 14/U.S. 287 intersection. At each tile, the difference in dB between the two measurements (2009 and 2013) was computed. The mean difference for this set of data is 10.4 dB in favor of Site A. This number is a bit misleading, however, because it includes comparisons between signals at the noise floor of the receiver (-126 dBm) where measurements are not very reliable. In a mobile environment, the minimum useable signal for a typical P25 subscriber radio is -106 dBm (comparable to DAQ 3.4 and 2% BER). If we eliminate all samples where both sites are below -106 dBm (after adjusting for a 159 W ERP), there are 837 remaining samples and the mean difference between samples is 7.5 dB in favor of Site A.

Thus, our best assessment of Site A is that it will produce, on average, signals 7.5 dB stronger than Middle Bald Mountain in the Poudre River Canyon. In Figure 4 below, we have plotted the difference levels.

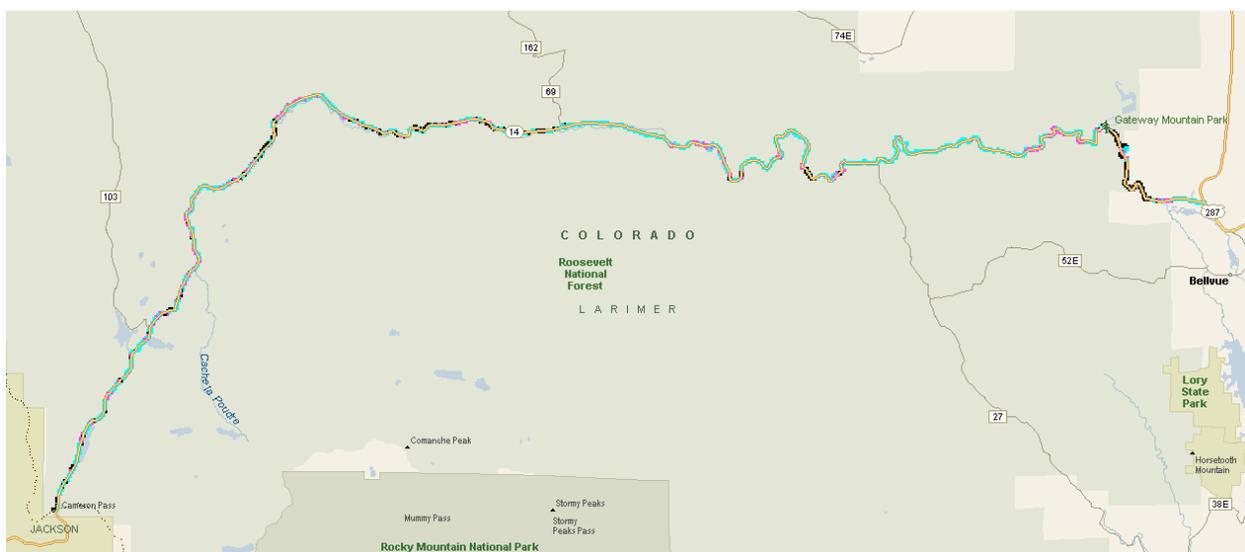


Figure 4 - Signal Difference Between Middle Bald and Site A

The following legend applies to Figure 4:

$\Delta > 3 \text{ dB} = \text{Cyan}$

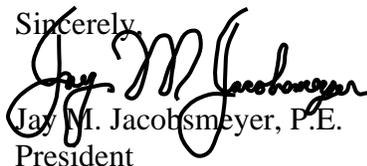
$-3 \text{ dB} < \Delta \leq 3 \text{ dB} = \text{Magenta}$

$\Delta \leq -3 \text{ dB} = \text{Black}$

Where Δ is Site A - Middle Bald. It is clear from Figure 4 that Site A is the better site in the vast majority of locations in the Canyon.

If you have any questions regarding this report, you can reach me at (303) 759-5111 or via email at jacobsmeyer@pericle.com.

Sincerely,



Jay M. Jacobsmeyer, P.E.
President

Attachment:

1. Difference Plot
2. Grid File Spreadsheets (submitted electronically)

Site A vs. Middle Bald Mtn -3, 3 dB = Black, Magenta, Cyan

