ANRITSU
SINCE 1895

LMR Master™ Land Mobile Radio Modulation Analyzer S412E

P25 Simulcast Case Study: Yosemite National Park

Implementation of a CAD/AVL Data System for Transit, Traffic Monitoring, and Portable Roadside Communications

Mobile Test Antenna Configuration

P25 Simulcast operation works well (especially with LSM) even in environments with a combination of high levels of multipath and significant non-capture overlap as long as the delay spread values are low enough.

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Simulcast system design is commonly used in P25 communications systems. Transmitters at multiple locations are configured to send the same signals on the same frequency. The advantage is that fewer frequencies are needed to serve users over a wide area and all users hear the same content without having to switch channels.

Simulcast systems have the transmitters locked to GPS stabilized references, so frequencies are synchronized to within 1 Hz. The transmitted audio or data must also be synchronized. If the synchronization is not done, the signals will interfere with each other causing “holes” in coverage.

There are software packages that can predict simulcast coverage, but prediction accuracy is limited by the level of the terrain models.

The normal process to build a simulcast system is to perform computer predictions, install the transmitters with backhaul, and then adjust transmitter power, antenna pattern and audio delay to manage received results in overlap areas.

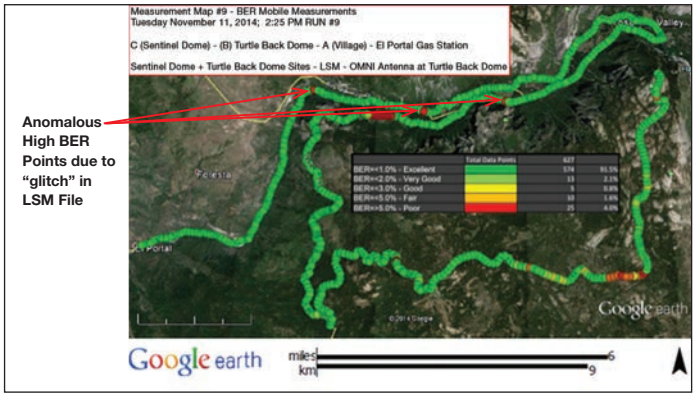
Yosemite National Park commissioned the engineering teams from IBI Group and Hatfield and Dawson Consulting Engineers to study the installation of a VHF P25 radio system for visitor busses. Initial software predictions indicated two transmitter locations would serve the entire bus route. The engineering team was worried about the accuracy of the predictions due to reflections off the vertical rock walls. Spot signal strength measurements of signals from existing YNP repeater sites were made along the bus routes. In many locations the measured signal strength was significantly stronger than the predictions, confirming the worry.

The engineering team knew Anritsu supplied a portable P25 test instrument that can measure and map RSSI, Mod Fidelity and BER. The LMR Master S412E has an internal GPS receiver that tags the location of each measurement and exports its results as Google Earth maps.

Anritsu was initially commissioned to do coverage maps with 3 separate transmitter locations. A temporary transmitter comprised of a vector signal generator with P25 1011 Hz BER signal files and 50 watt amplifier was sequentially moved from one location to another. The results showed that the reflections from the granite walls did not cause coverage holes.

After some research, it appeared that two Anritsu vector signal generators could be synchronized using Trimble GPS reference oscillators. Not only were the references synchronized with the 10 MHz signals from the reference oscillators, but also the P25 signal files were synchronized by starting them at the same moment based on the 1 pulse per second signal from the Trimble references. The result was a temporary “true simulcast” signal environment.

Anritsu was then commissioned to measure coverage of a variety of “temporary” simulcast system configurations to help decide on transmitter location, antenna pattern, and transmitter signal type. P25 simulcast systems often use a special “Linear Simulcast Modulation” (LSM) that is more forgiving of multipath. In this case, LSM did perform better than C4FM. The downside of this modulation is that it requires more expensive, linear amplification.



BER Test Results: Sentinel Dome & Turtle Back Dome Sites - LSM - OMNI - Sentinel Dome / Yosemite Village / El Portal

The results of these tests allowed optimum location selection of the two transmitter locations and modulation type by providing certainty of good overall BER coverage for the busses.

Protect your investment!

Input Protection Module eliminates risk of overpowering.

The MA25200A high power protection module safeguards the LMR Master S412E ports from high power portable, mobile, or base station transmitters. It can accept 125 watt base station transmitters for up to one minute and 25 watt mobile transmitters for indefinite periods. It combines the signal generator port into the test port to support receiver sensitivity testing.

High Power Tx/Rx Input Protection Module MA25200A

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