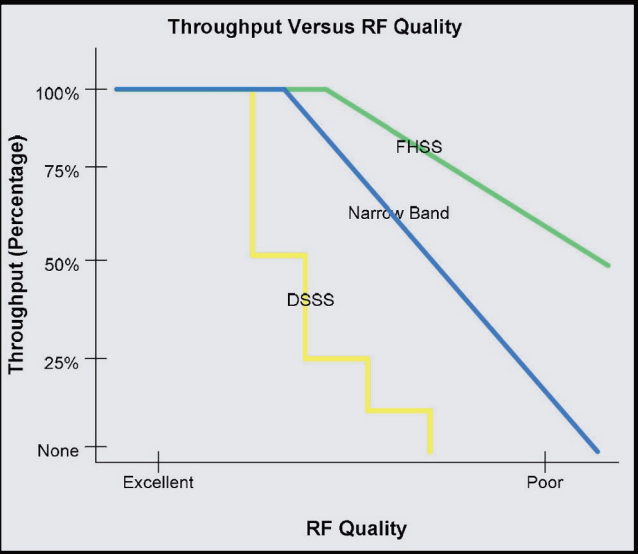
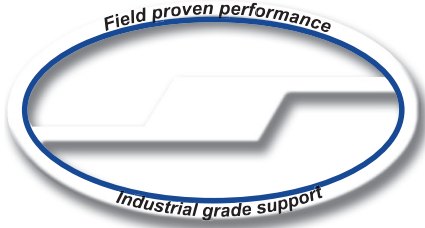


Impact of RF Link Quality Degradation



Link quality is signal to noise. Quality may degrade due to increasing noise or weakening signal.

a 1.5 m long bracket mounted on a 2.5 metre structure and at the STP site an omni directional antenna attached to a 1.5 m long bracket mounted on a single storey building. The radio has been operating successfully ever since and SWC is happy with the performance.



DATA-LINC GROUP
The Industrial Network Communication Experts

About Sydney Water

Sydney Water provides drinking water, recycled water, wastewater services and some stormwater services to more than four million people in Sydney, Illawarra and the Blue Mountains. Drinking water is sourced from a network of dams managed by the Sydney Catchment Authority, then treated and delivered to customers’ homes and businesses by Sydney Water.

Sydney Water, a statutory State owned corporation, wholly owned by the New South Wales Government has three equal, principal objectives:

- * to protect public health
- * to protect the environment
- * to be a successful business.

About Wired & Wireless Solutions International

Wired and Wireless Solutions International (WWSI) distributes and designs some of the world’s leading products, solutions, and services with a focus on enabling practices for improving personal/organisational/technological performance, reliability and sustainability. They apply their substantial knowledge, experience and training to providing best of class solutions.

Their services cover Training, Facilitation, Management, Consulting, Design, Development, Implementation, Maintenance, Communications, Health & Safety

Systems, IT Networks and Leadership. WWSI began in 1983. Today they serve Australasia, the Indian Sub-continent and the Middle East with Business Units that include Distribution, Maintenance, Software as well as Training and Consulting. The WWS International Group mission is to set the highest possible standards in Solutions to Organisations in the business areas of Distribution, Maintenance, Software Development, Training and Consulting.

About DATA-LINC GROUP

Since 1988, Data-Linc Group has provided reliable communication solutions for industrial automation and instrumentation systems. Data-Linc Group, an alliance partner with most major PLC manufacturers, provides expert technical support and communications consultation. Data-Linc’s industry proven RF technology has been successfully implemented in all major industries including automotive, consumer goods manufacturing/packaging, materials handling, metals and mining, oil and gas, pulp and paper, utilities, transportation and water/wastewater. With its line of wireless modems for the European Union, Data-Linc’s products and support are available worldwide with global partnerships, local support and global service. All Data-Linc products provide field proven performance and come with industrial grade support.



The Sydney West Camden
Recycled Water Supply Project



By
Richard Camilleri
Sydney Water

Peter Storey & Asghar Khan
Wired & Wireless Solutions International

Larry Terwisscha
DATA-LINC GROUP

Case Study: Public Utility— Water/Wastewater

The Sydney West Camden Recycled Water Supply Project

By Peter Storey & Asghar Khan—Wired & Wireless Solutions International,
Richard Camilleri—Sydney Water, Larry Terwisscha—Data-Linc Group

Abstract— Sydney Water constructed a 300mm diameter pipeline to transfer tertiary treated effluent pumped from its treatment plant to an earth dam located 9 km away. The GSM coverage in the area is very weak; there is no PSTN line and there is no line-of-sight between the two locations. Despite these challenges, Sydney Water working with Wired and Wireless Solutions International was able to design a network that not only worked, but worked well.

Background

Sydney Water has constructed a 300mm diameter pipeline to transfer tertiary treated effluent pumped from its West Camden Sewage Treatment Plant (STP) to a 60 megalitre earth dam located on the Elizabeth Macarthur Agricultural Institute (EMAI) property, 9 km away. The STP recycled water pumps are controlled by a Schneider Programmable Logic Controller (PLC) using cut-in/cut-out level signals installed at the dam. The GSM (Global System for Mobile Communications) Coverage in the area is very weak and there is no PSTN (Public Switched Telephone Network) line at the dam site the only option left for linking the dam site instrumentation with STP plant control system was a radio link. There is no line of sight between the two locations making the radio link planning more challenging.

Planning

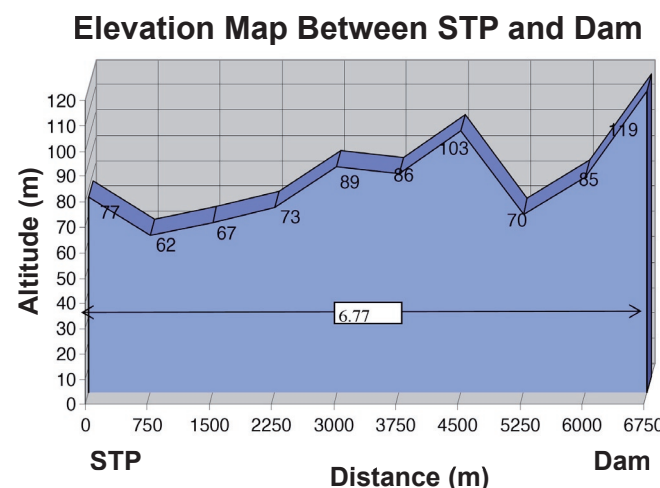
Factors to be considered for radio link planning.

- Frequency band
- Transmitter output power
- Receiver sensitivity & selectivity (ability to separate signal from noise)
- Spreading method (FHSS vs. DSSS)
- RF noise level
- Antenna type and gain
- Transmission Line (coax) Quality



Site Survey

We conducted the site survey and obtained the Geo Coordinates for the STP and dam site. After feeding all the details into the path loss software, we found that the probability of line-of-sight (LOS) communication between STP and the dam site was low.



Type of Radio

Since there was significant interference with LOS and the area is covered with tall trees, the 2.4GHz frequency option was ruled out and the obvious choice was to use the more robust 900MHz Frequency Hopping Spread Spectrum (FHSS) radio.

Radio Survey

We conducted a radio survey by setting up a temporary pair of radios to determine the reliability of the link. It was very critical to choose the right type of antenna due to poor line-of-sight.

We conducted the test by using the following equipment.

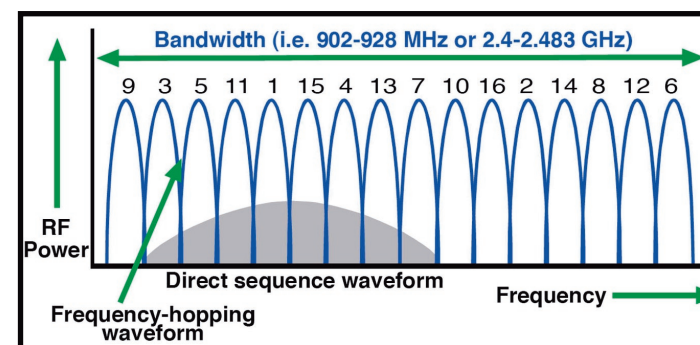
- 1) SRM 6210E Radio, Qty 2
- 2) 9 dBi omni antenna
- 3) 12 dBi Yagi antenna

At the STP we have installed a 9 dBi omni directional antenna and at dam site we installed a 12 dBi Yagi antenna. We powered the radio with a battery, pointing the antenna towards the STP and the link was established. The RF link light was on and we were able to successfully ping the radio at the other end.

Reasons why the *Data-Linc* Radio was successful in this project

- 1) Modulation Technique: Smart Spectrum (proprietary Frequency Hopping Spread Spectrum)

Technology— Spread Spectrum



Direct sequence (DSSS)

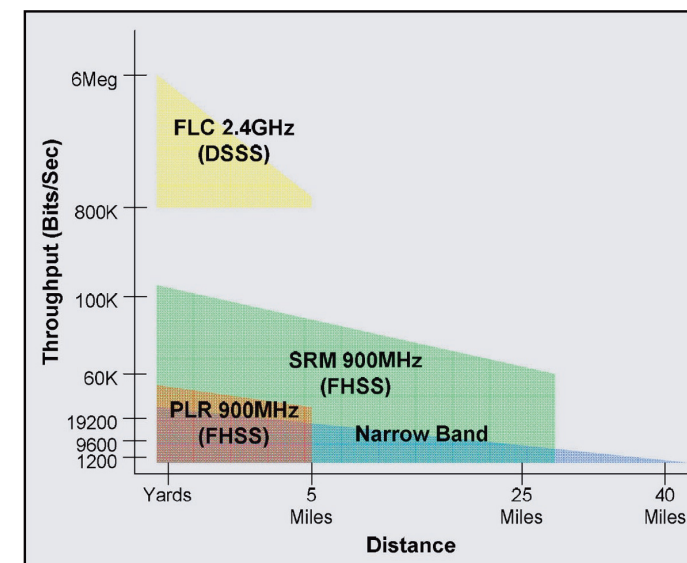
- High data rates (54 Mbps+)
- Low latency
- 802.11 technology
- Short to medium range
- Wide channels prone to crowding

Frequency Hopping (FHSS)

- Moderate data rates (0.1-1Mbps)
- More latency
- Proprietary technologies
- Long range (25+ miles)
- Excellent interference immunity

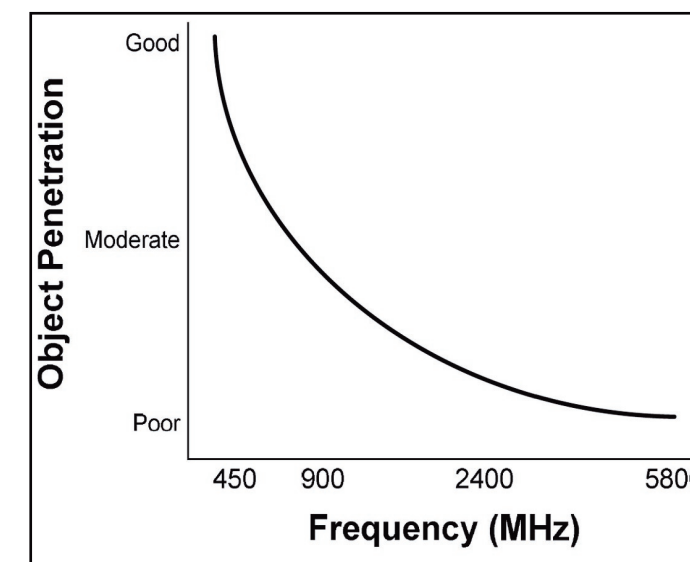
- 2) Distance and Throughput: RF Speed is higher than actual throughput

Distance and Throughput



Note: RF speed is higher than actual throughput.

- 3) Object Penetration: At 900MHz object penetration is better than 2.4GHz



RF Bands and Line-of-sight

Conclusion

Sydney Water saved the cost of installing mast towers, by installing the dam site radio in an outdoor kiosk with the Yagi antenna attached to