Raptor XR Case Study

RCS-0418-1
Date:2 April 2018

Country: Philippines

City of Davao Del Sur to Samal Island UHF Broadband Deployment and Performance Overview

Project Overview

The Philippine government is socially and financially committed to bringing the benefits of the internet to the most remote locations of its 343,448 square kilometers archipelagic nation. The Department of Communication and Information (DICT) is the responsible government agency. Wireless broadband is a key technology to meet this national goal. The use of VHF and UHF TV White Space spectrum to reach deep into remote villages and over water to island settlements is the most technically sound and economical choice. VHF and UHF Raptor XR transmissions are unaffected by rain and fog and provide transmission through trees. This Case Study shows in detail how these capabilities provide broadband connectivity between an urban and remote island site.

Table 1. On-Air Configuration and Performance Summary

- **Line of Sight Range: 13.1 km (8.25 miles)**

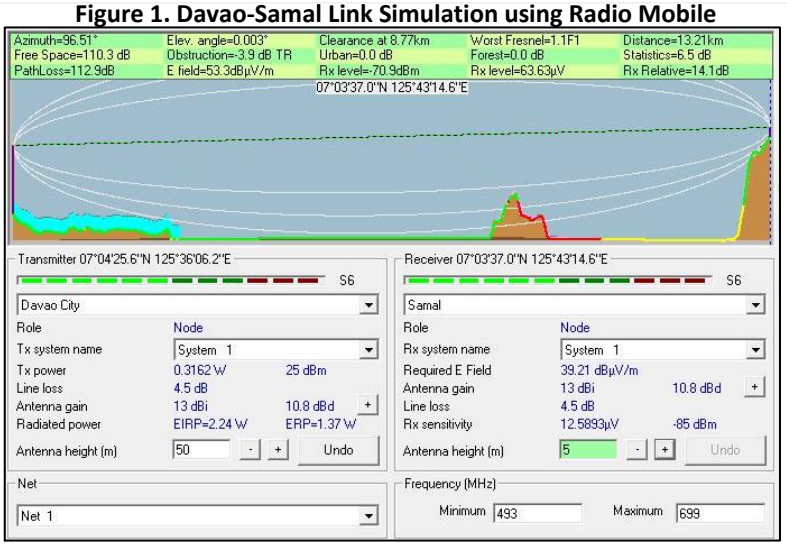
Davao Del Sur Base Station:

- **Tx Center Frequency: 695 MHz**
- **Tx Average Output Power: 25 dBm @ 8 MHz (.316 RMS Watts)**
- **Tx Antenna Gain: 13 dBi**
- **Average Transmission Line Loss: 4 dB**
- **Tx EIRP: 34 dBm**
- **Rx Center Frequency: 497 MHz**
- **Rx Measured Noise Floor: -78 dBm @ 8 MHz**
- **Average Rx Signal: - 63 dBm**
- **Rx Signal Range: -60 to -80 dBm**
- **Average Full-Duplex Downlink Rate: 8 Mbps**

Samal Island Remote Station

- **Tx Center Frequency: 497 MHz**
- **Tx Average Output Power: 25 dBm @ 8 dBm (.316 RMS Watts)**
- **Tx Antenna Gain: 13 dBi**
- **Average Transmission Line loss**
- **Tx EIRP: 34 dBm**
- **Rx Center Frequency: 695 MHz**
- **Rx Measured Noise Floor: -87 dBm**
- **Average Rx Signal: -80 dBm**
- **Rx Signal Range: -79 to -82 dBm**
- **Average Full-Duplex Rate: 8 MBps**

Figure 1. Davao-Samal Link Simulation using Radio Mobile



Deployment Process

The deployment processed consisted of five critical steps:

1. DICT provided the site coordinates and frequency channels. The base station location is shown in the lower right of figure 2. The Samal site is embedded In a highly wooded area.

2. A radio propagation simulation was done using Radio Mobile, a free application at http://www.ve2dbe.com/english1.html. The results of the simulation are shown in Figure 2. Actual measured, or manufacturer specifications were used. Simulation results predicted an average received signal level of approximately -71 dBm at each site.

3. The Raptor XR, in scanning mode, measured the local received noise floor power. The Rx signal power must exceed the noise floor power by 4-5 dB to sustain a minimum connectivity of 6 Mbps. Table 1 shows actual deployed operational parameters and received signal levels.

4. Figures 2 and 5 show the Raptor XR and antenna site configurations. Note at Samal island the low antenna height and the antenna pointing into trees. A condition not possible with microwave based systems.

Figure 2. Davao Del Sur DICT Field Station to Samal Island Field Station Deployment Overview

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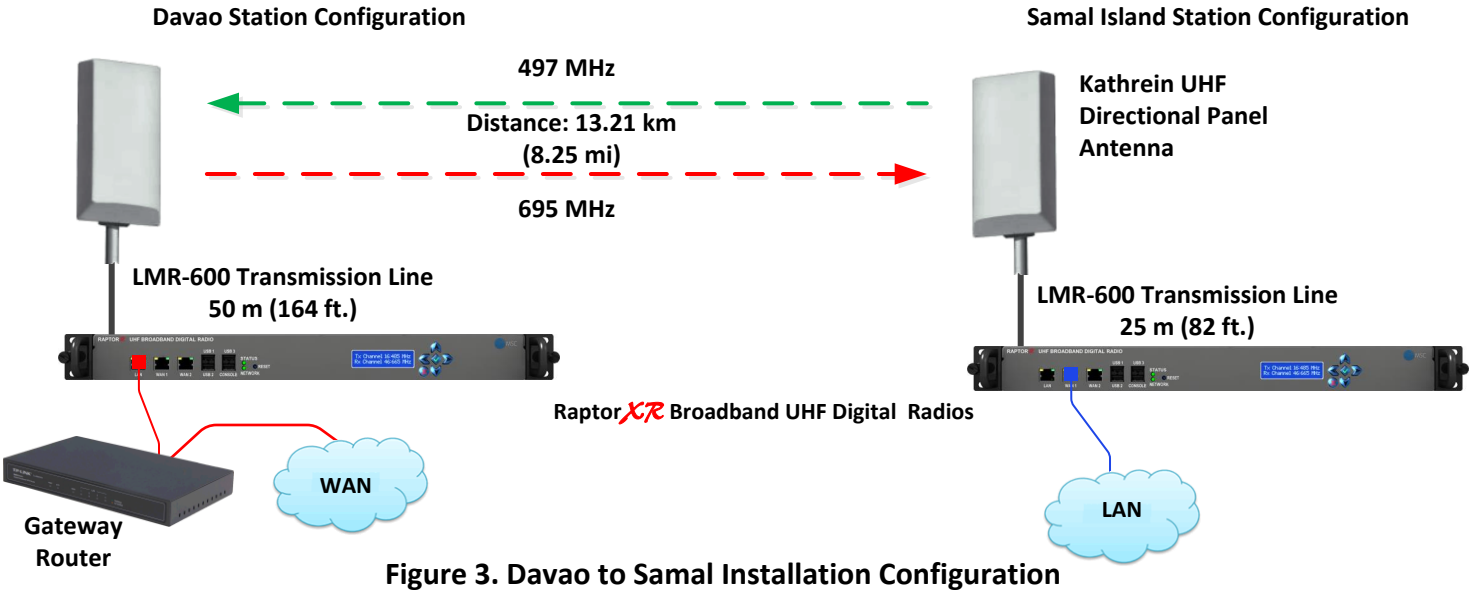

Figure 3. Davao to Samal Installation Configuration

Figure 4. About the RaptorXR Broadband UHF Digital Radio

RaptorXR is a full-duplex broadband digital radio covering all international VHF and UHF TV spectrum channels. RaptorXR capabilities support:

- **Full-duplex data rates from 35 Mbps @ 6 MHz BW to 43 Mbps at 8 Mbps.**
- **Transmission distances of 25+ km (15+ miles) with appropriate antenna and antenna height**
- **Excellent transmission over land and water**

Data sheet: http://www.metricsystems.com/wp-content/uploads/2017/08/MSC_Raptor-XR-Domestic-UHF-Single-Link.pdf

Notes on the Deployment process

1. The Davao to Samal Link was engineered and deployed by KP Systems of Inchon, Korea.

2. The usable data rate could have been increase to nearly 20 Mbps

- **At the base station by tower mounting the RaptorXR – this would have delivered 3 dB (doubled) more Tx power and reduced the noise floor by 4-6 dB.**
- **At the Samal site by reducing the transmission line coax length and raising the antenna by 3-5 meters this would have increased EIRP and lowered the noise floor an additional 3-4 dB.**

Needless to say, KP systems and their local contractors accomplished an industry first: A broadband long-range over land and water TVWS spectrum link.

Figure 5. Davao Del Sur DICT Field Station to Samal Island Field Station Equipment Deployment Overview