TV White Space (TVWS) Experimental for Application in Remote Area

ASEAN IVO Forum @ Hanoi
24th November 2016

Presentation Outline

- Background
- Project Implementation Plan
  - Chini Lake, Malaysia
  - Bogo, Philippines
- Technical Update
  - Radio propagation evaluation
  - Spectrum measurements
- Support from Government/Industry

Background

Background

- Project Title:
  - TV White Space (TVWS) Experimental for Application in Remote Area
- Project Theme:
  - Social Renovation in Rural Areas and/or Urban Areas
    - To develop solution for hydrological quality monitoring in rural area and emergency network in urban area
- Project Members:
  - MIMOS & UKM, Malaysia
  - NICT, Japan
  - University of San Carlos, Philippines
- Amount:
  - USD 29,900
- Duration:
  - 16 months (Jul 2016 – Oct 2017)

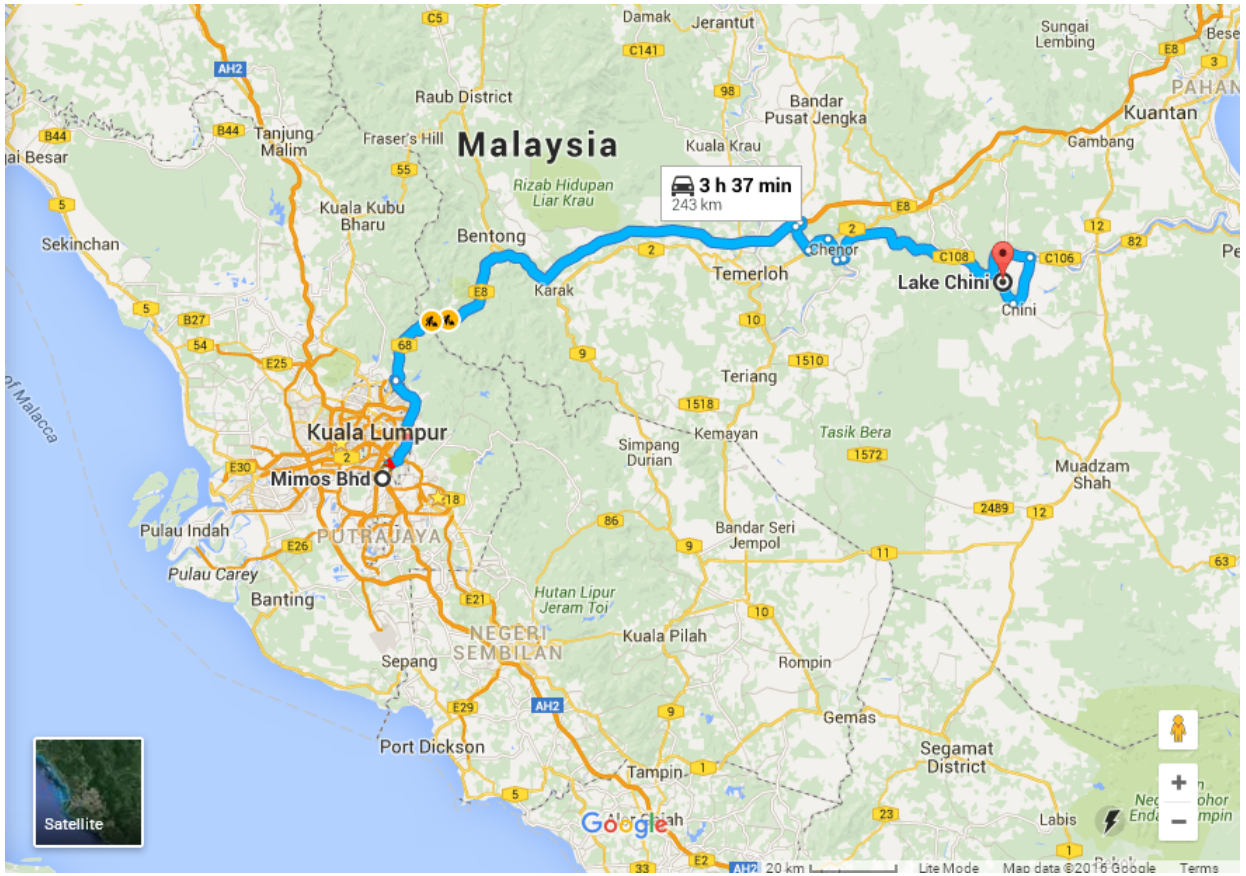
Project Impacts

- This project enables connectivity for sensors and internet in rural area using unutilized spectrum in TV band, also known as TV white space (TVWS)
- Two potential experimental sites have been identified with the following benefits;
  - as hydrological monitoring system at **Chini Lake (Malaysia)**
  - as emergency wireless networking at **Bogo (Philippines)**
- These applications are very critical for natural disaster management.
- These applications are useful for people in rural areas as their daily life will be affected by any problem related to environmental pollution and natural disaster.
- The implemented system provides ICT solutions to protect the environment and saves human lives.

Implementation Plan

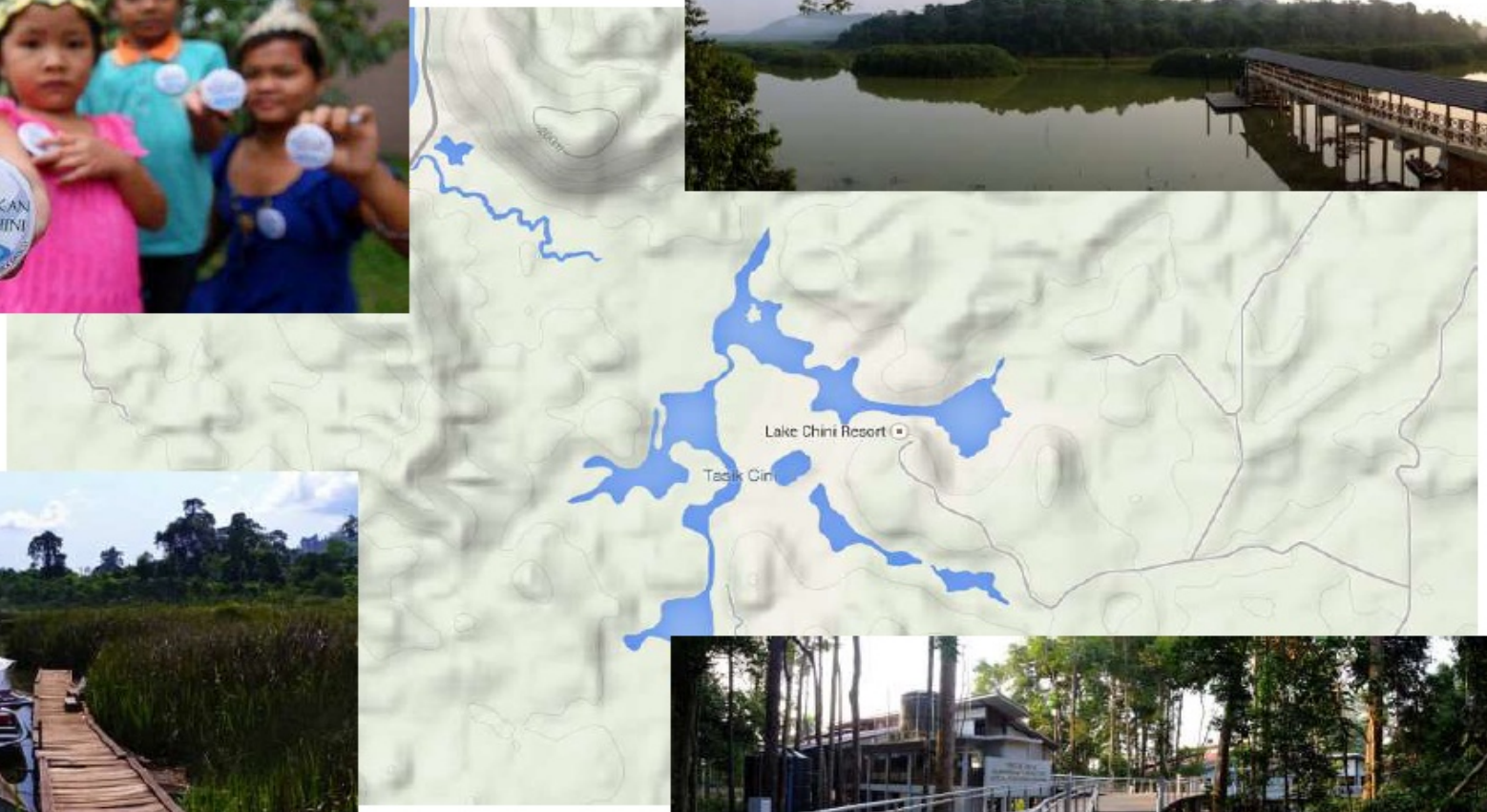
Project Implementation: Malaysia

- Location: Chini Lake (Tasik Chini), Pahang
  - 240km (East side of Kuala Lumpur)

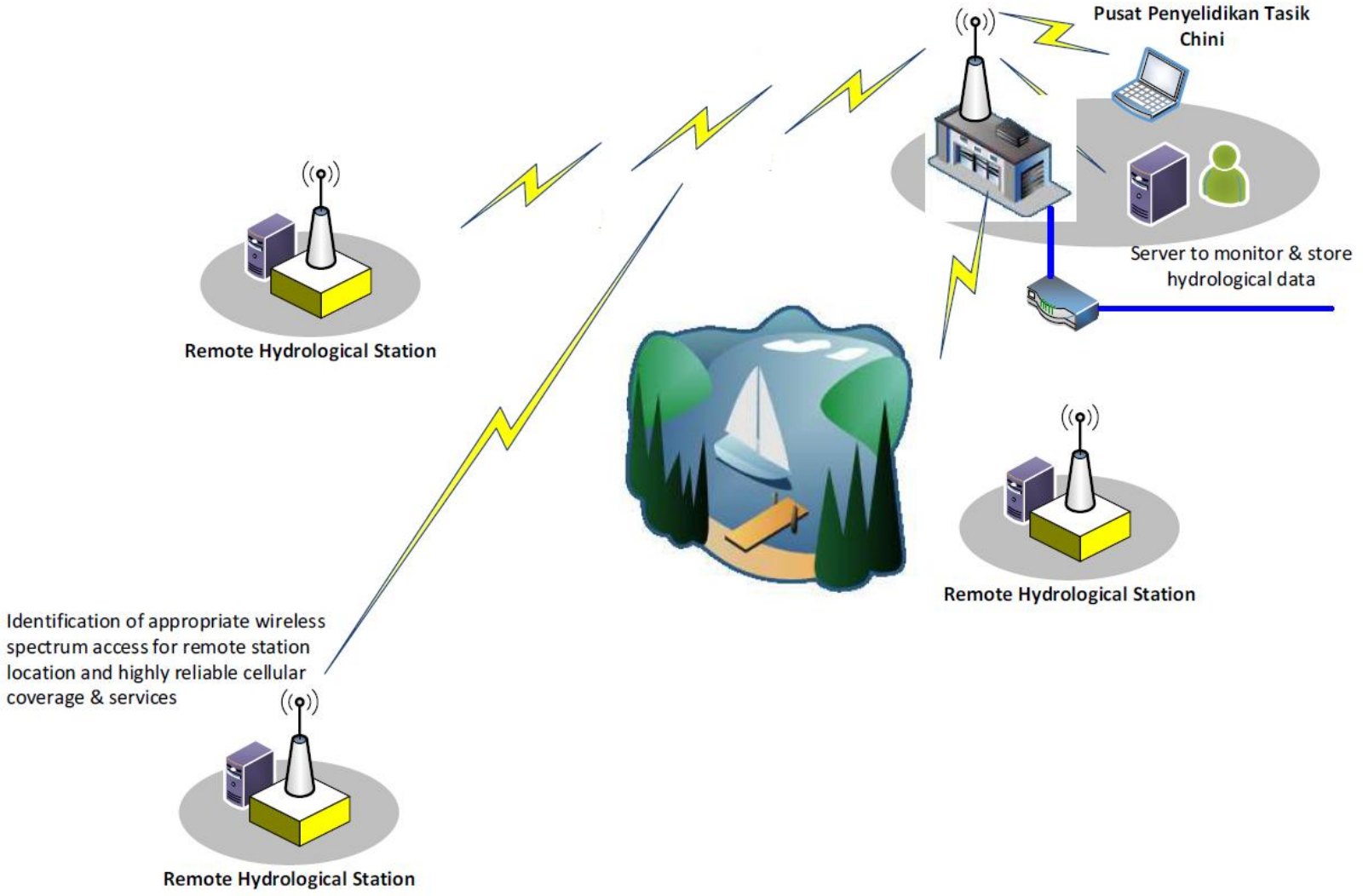


- Chini Lake is a fresh water lake near the Pahang River in central Pahang, Malaysia. The lakeshores are inhabited by the Jakun branch of the Orang Asli (indigenous people)
- The 12,565 acres (5,026 hectares) Chini Lake is the second largest fresh water lake in Malaysia and is made up of a series of 12 lakes. Chini River, which drains from the lake, flows into Pahang River.
- Chini Lake is one of the UNESCO Biosphere Reserve status sites in Malaysia.

Chini Lake (Tasik Chini)



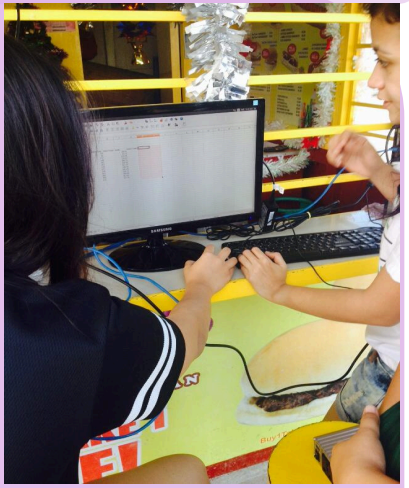
Network Architecture (Chini Lake)



Deployment in Bogo City, Philippines

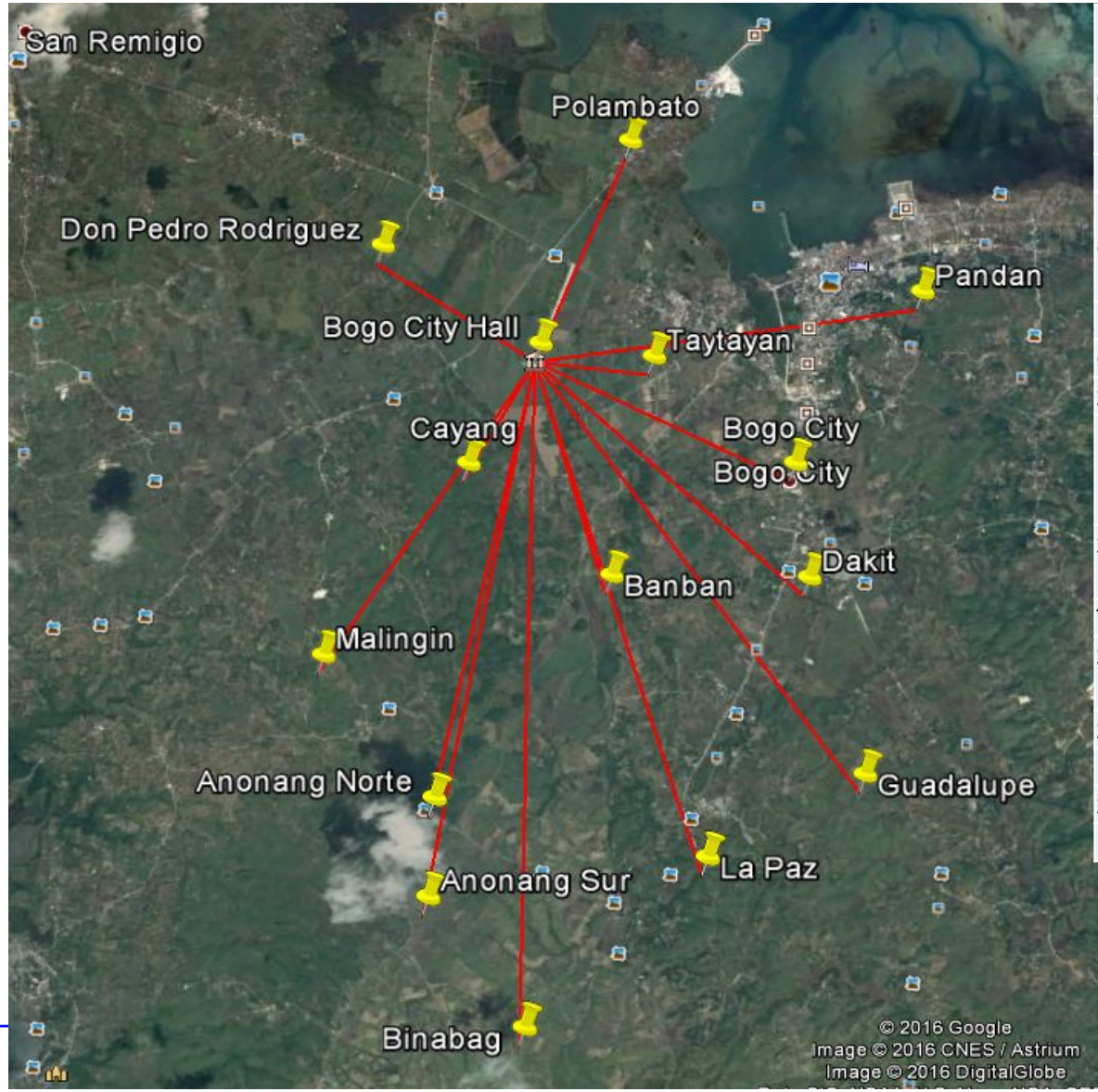
Outdoor Testing North Cebu Blind Spot

Bogo City Terminal



Our initial measurements had so far identified it as a blind spot so the use of TVWS technology could benefit the people living in the area and in the nearby municipalities.

Deployment in Bogo City, Philippines

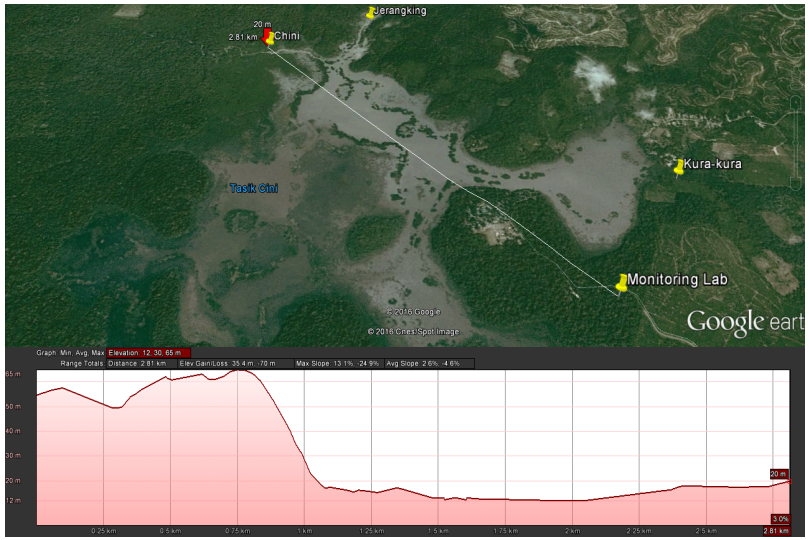


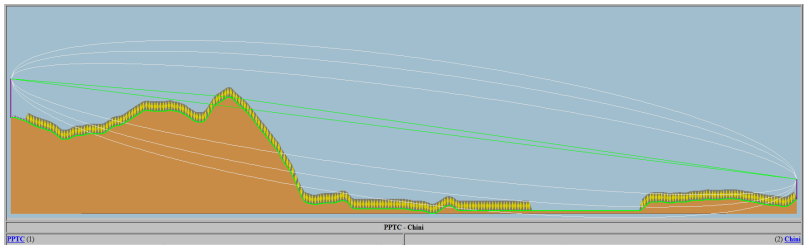
Baranggays	Distance from CBSAA (meters)	Baranggays	Distance from CBSAA (meters)
Cogon (Pob.)	453.28		
Bungtod (Pob.)	565.00	Gairan	2,493.07
Bogo City	719.61	Banban	2,608.84
La Purisima Concepcion (Pob.)	1,113.90	Siocon	2,898.07
		Polambato	3,016.28
		Cayang	3,275.25
Lourdes (pob.)	1,176.19	Nailon	3,528.78
Carbon (Pob.)	1,369.42	Guadalupe	3,751.91
Sudlonon	1,401.64	Marangog	3,944.20
Pandan (Pandan Heights)	1,433.35	Don Pedro Rodriguez	4,324.87
		La Paz	4,544.91
San Vicente (Pob.)	1,539.94	Malingin	5,235.14
		Anonang Norte	5,280.27
Taytayan	1,540.31		
Santo Rosario (Pob.)	1,639.16	Odlot	5,675.81
		Anonang Sur	6,041.19
Santo Niño	1,665.65	Binabag	6,624.94
Dakit	1,815.24		
Sambag (Pob.)	1,825.15		
Libertad	1,869.72		

Technical Update

Radio Propagation Evaluation

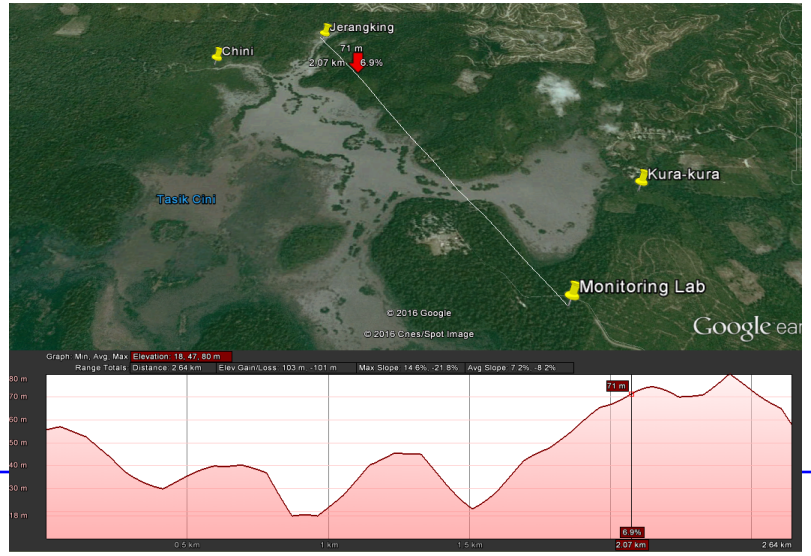
Chini Station

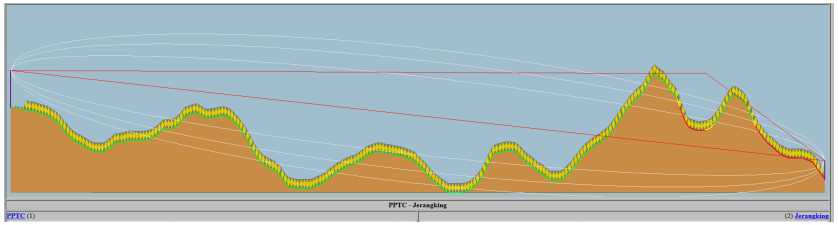




Performance	
Distance	**2.783 km**
Precision	10.0 m
Frequency	450.000 MHz
Equivalent Isotropically Radiated Power	6.310 W
System gain	142.68 dB
Required reliability	90.000 %
Received Signal	-77.11 dBm
Received Signal	31.23 µV
Fade Margin	**18.07 dB**

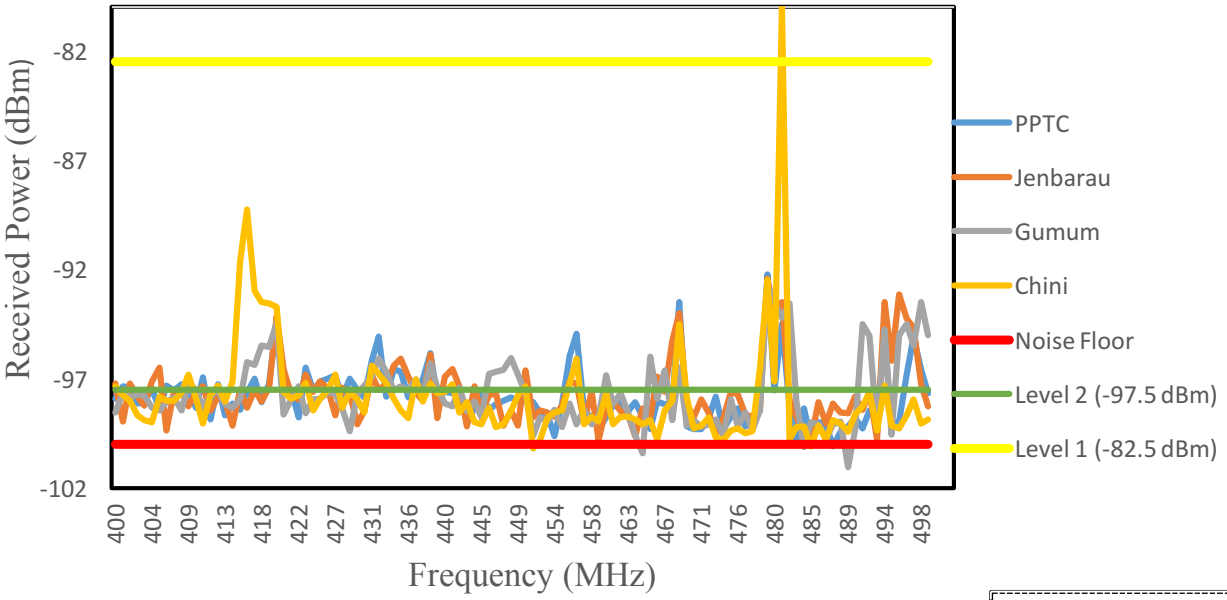
Jerangking St.

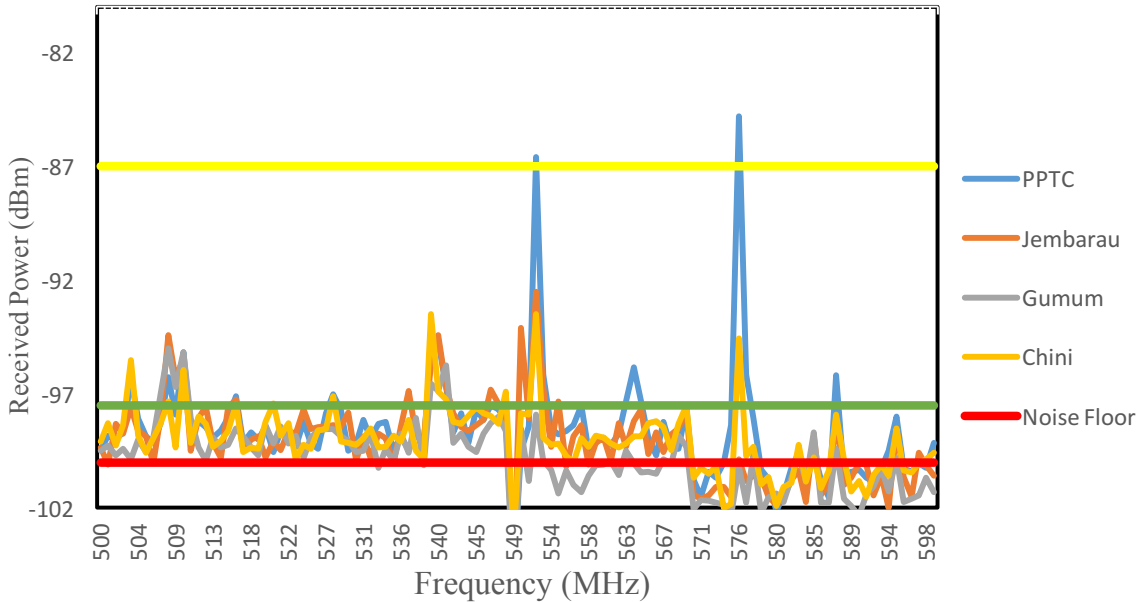




Performance	
Distance	**2.571 km**
Precision	10.0 m
Frequency	450.000 MHz
Equivalent Isotropically Radiated Power	6.310 W
System gain	142.68 dB
Required reliability	90.000 %
Received Signal	-103.19 dBm
Received Signal	1.55 µV
Fade Margin	**-8.01 dB**

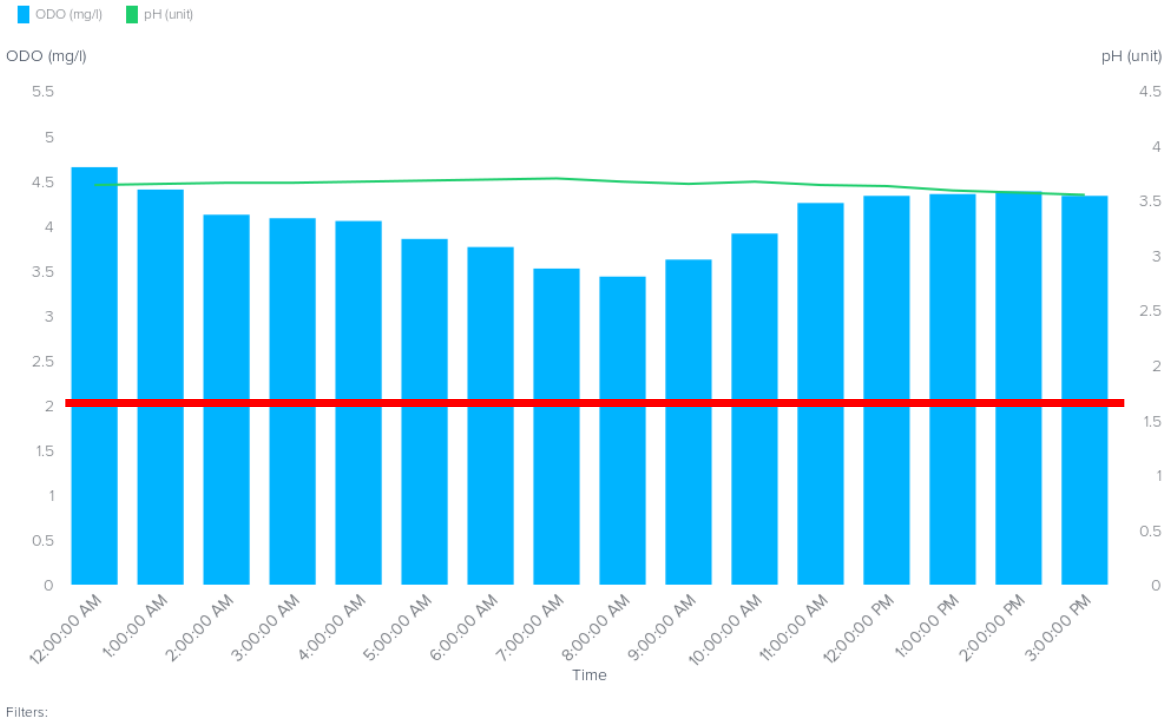
Spectrum Measurement Results





Recent Measurements at Jemberau Station

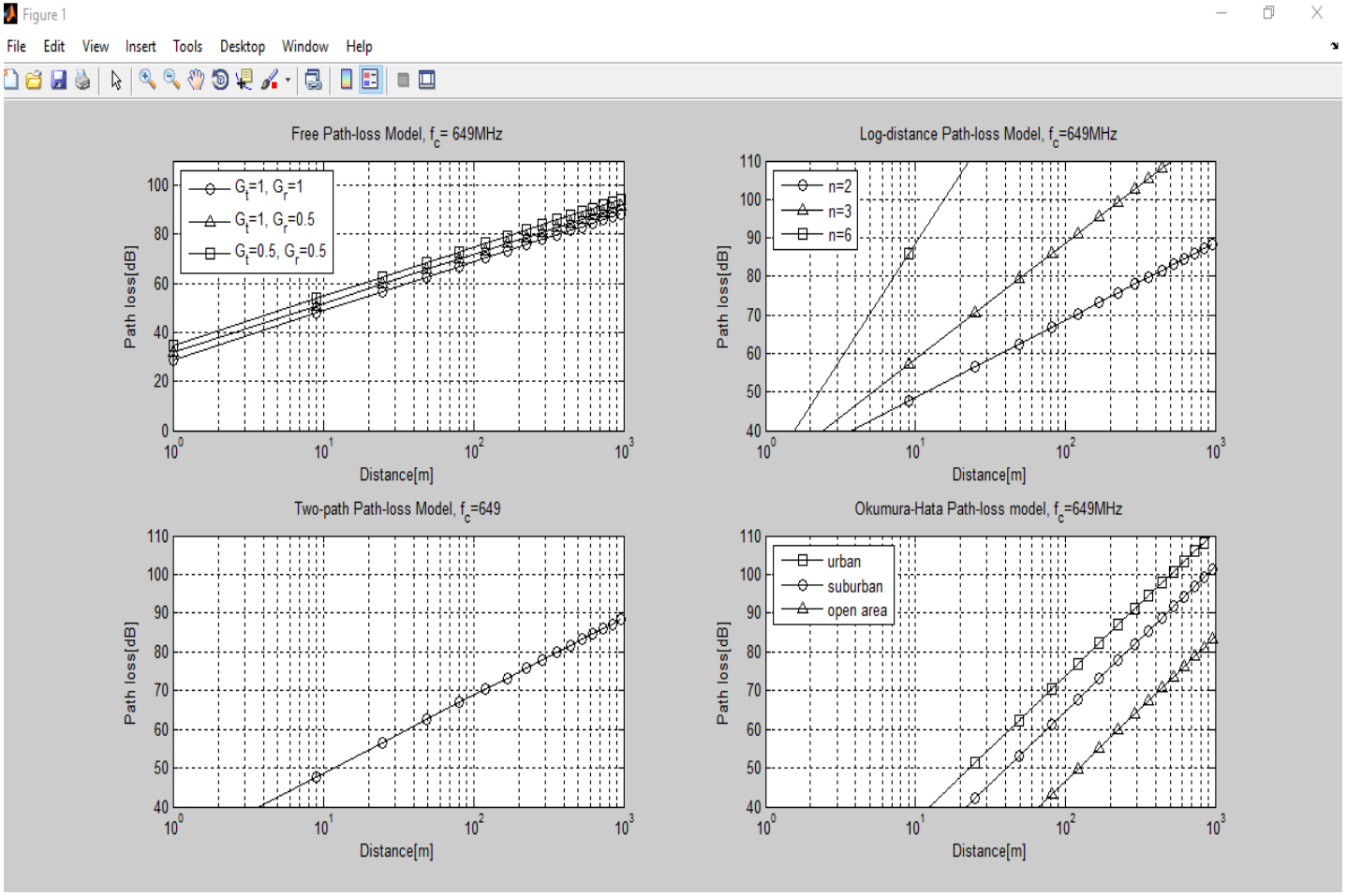
Acidity (pH) and Dissolved Oxygen (ODO), Saturday, 15/10/2016 12:00 am to 3 pm



GUIDELINE:

- **0-2 mg/L: not enough oxygen to support life**
- **2-4 mg/L: only a few fish and aquatic insects can survive**
- **4-7 mg/L: good for many aquatic animals, low for cold water fish**
- **7-11 mg/L: very good for most stream fish**

Deployment Sites for TVWS Experiment - University of San Carlos Talamban Campus, Cebu City



Path Loss Simulation

Support & Achievement

Government Support

- Philippines
  - Department of Information and Communications Technology (DICT)
    - Directly under the purview of the President of Philippines
    - Endorse the use of TVWS for internet connectivity in public school
  - National Telecommunication Commission (NTC)
    - Regulator
    - Expect to obtain the experimental license
- Malaysia
  - Malaysia Communications and Multimedia Commission (MCMC)
    - Regulator
    - Presented measurement results and expect to obtain the approval
  - Industry Forum
    - Platform to promote TVWS
    - Plan to host industry forum in Mar 2017

Malaysia's Prime Minister Visit to Chini (15 Oct 2016)

Current Progress & Achievement *(Jul – Nov 2016)*

- Specific experimental sites for installation identified
- Radio propagation study conducted at Chini and Bogo
- Spectrum measurement at Chini Lake and Bogo City conducted
- TVWS equipment by NICT are ready
- Discussion and support from the regulator in Malaysia and Philippines
- Presentation to the Prime Minister ☺