Sharing needs and discussing opinions for social implementation of 802.11ah in Japan

802.11ah Promotion Council

Needs and Expectation for Social Implementation of Wi-Fi HaLow

■ Needs by Industry Sector

- ☐ FA・Industry：Digitalization of analog meters
- ☐ Municipalities：Safety and security for the elderly and children, infrastructure monitoring in local cities (monitoring of rivers and local roads, illegal dumping, etc.)
- ☐ Agriculture：Crop growth management using various sensing and data for smart agriculture
- ☐ Logistics：Safety management of logistics warehouse using video and sensing, vital monitoring of workers
- ☐ Medical care・Nursing care：Safety management of hospitalized patients in bed areas (checking vitals, raising beds, falling, etc.)
- ☐ Education：Safety monitoring in school buildings, monitoring of suspicious persons in school yards and gate/back gate areas

■ User requests ~ Expectation for Wi-Fi HaLow

- ☐ Commercial facilities (smart cities)
  - Existing facilities are often built with wired basis, so that, wired system is often adopted when new facilities are installed.
  - When a wireless infrastructure can be built to cover the entire facility, it is expected to utilize for monitoring human-flow and retention including crime prevention, and environmental management of temperature, humidity, CO_2, etc.
- ☐ FA・Industry
  - 2.4GHz Wi-Fi is used for specific terminals and systems due to areas and bandwidth limitation.
  - When a wide coverage environment that can connect terminals and devices is build, it will be possible to collect data and monitor that could not be achieved before.
- ☐ Municipalities
  - LTE is used for infrastructure to cover a wide area of government facilities and charged running cost.
  - It would be good to build a video system for community safety and security and disaster prevention with free-license.
- ☐ Medical care / Nursing care
  - 2.4GHz Wi-Fi is used for data communication in hospital bed areas, but area restrictions prevent the use of other systems.
  - When it has wireless system that can be cover the entire bed area, it will utilize for sensing and video monitoring.

Use Case ① Smart City
entry/exit management of commercial facilities and monitoring of crime prevention and human-flow

■ Demonstration overview

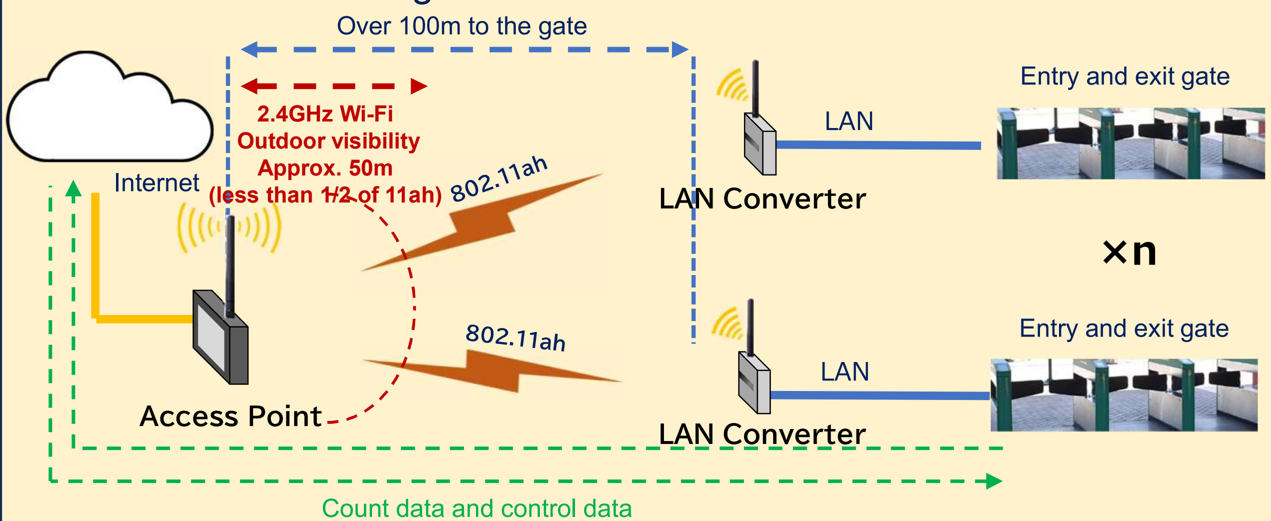
- Spectators access control at large leisure facilities

■ Purpose of the demonstration

- The current system using LTE have a problem with communication interruption due to access congestion. Therefore, by using Wi-Fi HaLow, we confirm that it is possible to accurately count the number of visitors entering and leaving the gate without communication interruption, and stably control the opening and closing of the gate.
- We will verify that the delay caused by Wi-Fi HaLow is not a problem with respect to the timing to opening/closing the gate.

■ Photo

■ Demonstration image



■ Challenges encountered during the demonstration and their countermeasures

- Needed to adjust the AP location considering the radio wave blockage by the building.
- Able to prove that uplink / downlink communication delay time to / from cloud under 11ah communication bandwidth and 10% duty environment don't affect gate operation.
- Although there was heavy rain due to a sudden downpour on the day of the demonstration, there was no problems with Wi-Fi HaLow communication.

■ Final results and implementation

- The gate operated at approximately the same timing as the LTE communication even when visitors pass gate continuously when tested both 4MHz and 2MHz bandwidths.
- By increasing the number of connected devices, the additional system which crime prevention and human-flow monitoring using video images can be operated.

■ Quantitative effects

- The current LTE system result in permanent running costs because it's required to contract for an LTE communication per gate, but Wi-Fi HaLow system can be operated without running cost.

Entry / exit management for commercial facilities will be operated with Wi-Fi HaLow without running cost.

Use Case ② Long-distance communication
Communication infrastructure with offshore work vessels

Demonstration overview

- Safety monitoring of offshore civil engineering works and port facility construction.
- Monitoring the operation of offshore work vessels
- More efficient equipment maintenance

Purpose of the demonstration

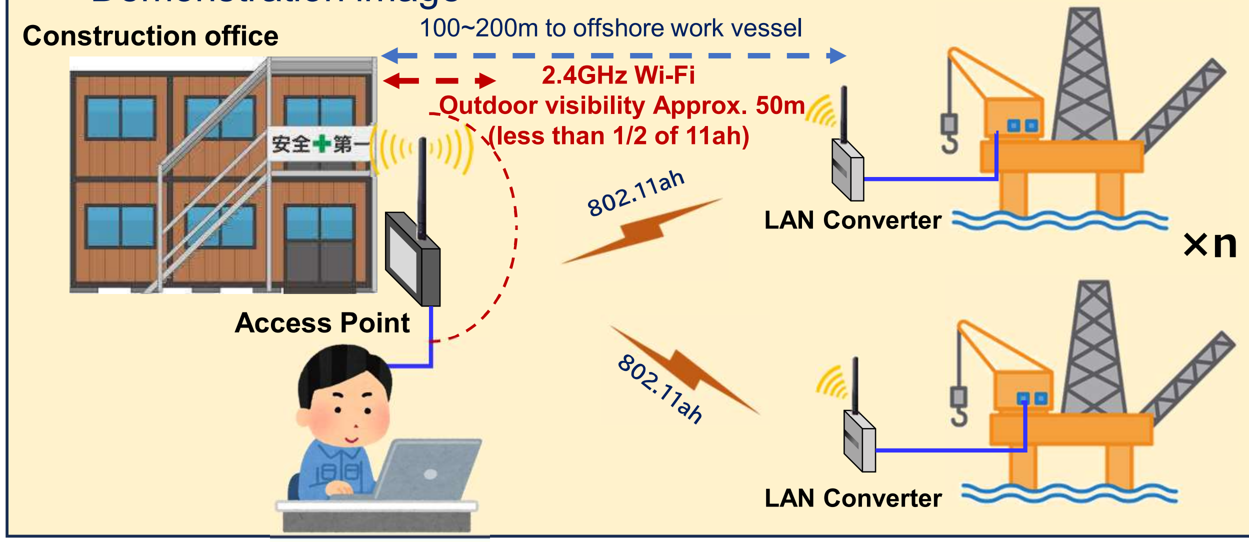
- Wireless communication with offshore construction machinery
  ▶Monitoring the operation status of construction machinery
  ▶Optimizing maintenance plans for construction machinery
- Real-time communication with work vessels at sea

Photo


Construction work at the port


Offshore Work Vessel

Demonstration image



Challenges encountered during the demonstration and their countermeasures

- Uses 802.11ah to realize communication between land and sea over long distances.
- Ethernet communication with facility devices can be easily made wireless.
- 802.11ah is the best choice since it does not require installation licenses or communication fees.

Final results and implementation

- Easy to set up communication facilities with offshore work vessels because it is the application of Wi-Fi technology.
- Can grasp the work status of offshore work vessels in real time.
- Can monitor equipment operating hours and optimize maintenance management as well.

Quantitative Effects

- Building and operating communication lines at low cost.
- Support for safe work through real-time equipment monitoring.
- ~~Reducing the time required for manual equipment inspections.~~

Marine communication will be solved by Wi-Fi HaLow ‘s IP communication instead of building dedicated facilities at huge cost.

Use Case③ Smart Factory
Monitoring hazardous areas and work areas in the factory and controlling AGV

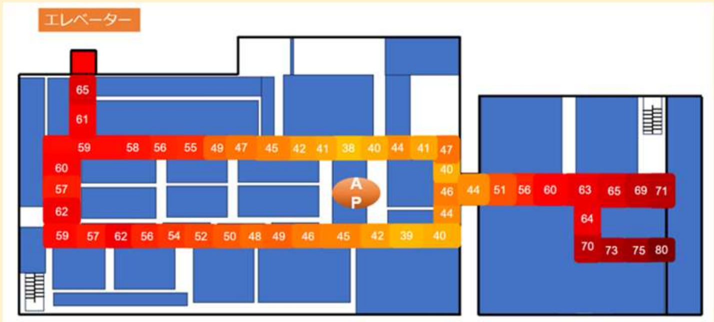
■ Demonstration overview

Replacement of 2.4GHz Wi-Fi for inside factories communications

■ Purpose of the demonstration

- Expansion of communication range
  Wi-Fi becomes problem when communicating over 100m such as the initial cost, operating cost, etc. Replacing Wi-Fi HaLow can expand the control range, and the number of access points will be reduced.
- Switching control groups
  Seamlessly switch access points to connect to when an automatic transporter crosses floors or buildings.
- Video transmission of the status of remote facilities at the system operation level.

■ Photo

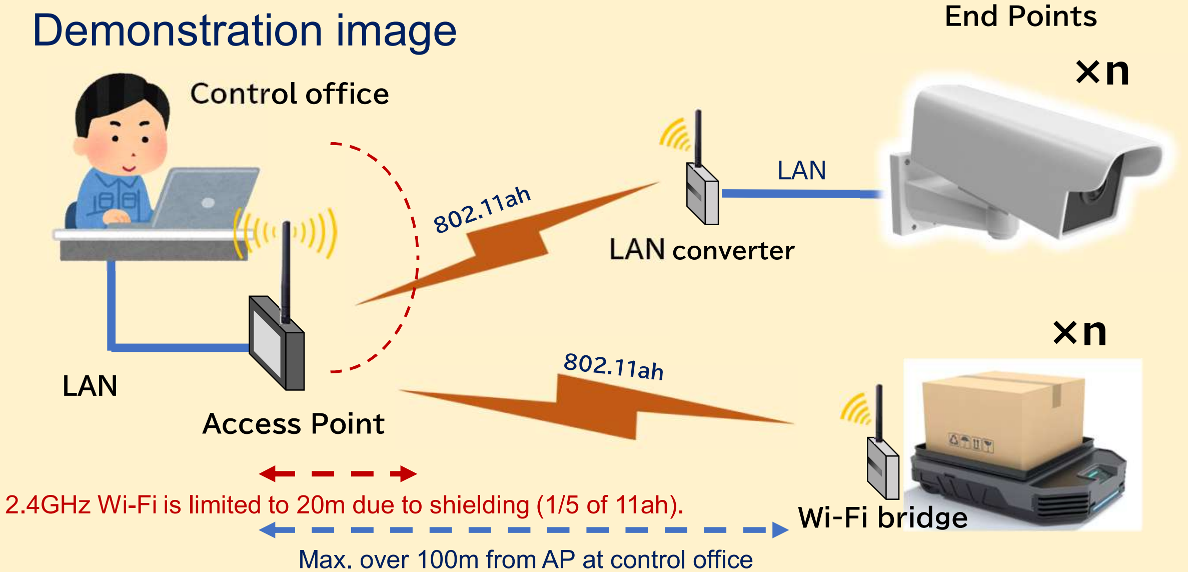


Receiving Sensitivity Heat Map

Luggage elevator

Wireless roaming
from the 1stf floor to the 2nd floor

■ Demonstration image



■ Challenges and their countermeasures for the demonstration

- Before starting demonstration, we created a receiver sensitivity heat map to determine appropriate placement locations for access point.
- In order to ensure a quick connection to the destination AP when an AGV boards the luggage elevator to cross a floor, the threshold for disconnecting the connection with the source AP was set to be cut off quickly.

■ Final results and implementation

- The current Wi-Fi 2.4GHz system requires five access points to operate due to interference and other reasons, but only one 11ah access point can be used.
- This has eliminated the connection problems that frequently occur when traveling in a luggage elevator.

■ Quantitative effects

- Compared to 2.4GHz Wi-Fi, the number of APs can be reduced to 1/5 (or even 1/10 in some areas).
- Reducing the number of APs can cut wiring and installation costs by half.

Wi-Fi HaLow achieve significant cost reductions and a stable communication environment in factories to replace 2.4GHz Wi-Fi.

Use Case ④ Smart City
Communication for LTE insensitive zone in underground area of commercial buildings and facilities

■ Demonstration overview

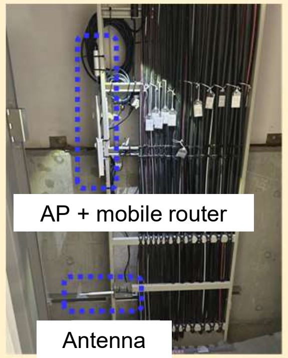
- Confirmation of various application operations underground of building which is radio insensitive zone

■ Purpose of the demonstration

- In existing buildings, additional wiring is difficult due to insufficient piping and available space.
- QR payment for users, parking lot vacancy status / EV charging station management in underground areas cannot cover by LTE and Wi-Fi.
- Aiming to realize DX solutions for underground parking, and optional network to support these solutions in collaboration with real estate companies.

■ Photo

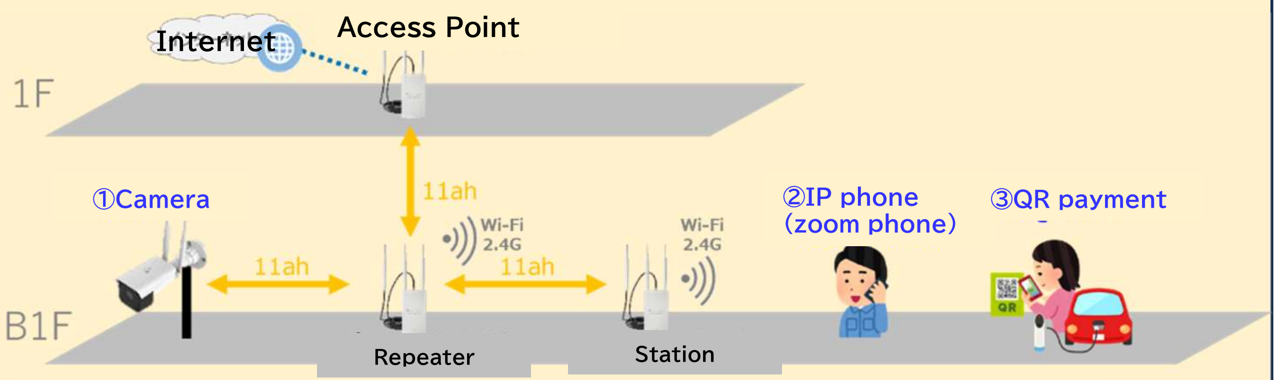
1F AP



B1F End point

B1F Camera

■ Demonstration image



Confirm if ①Camera, ②IP phone, ③QR payment can be used in underground areas

■ Challenges and their countermeasures for the demonstration

- AP is installed on the 1st floor assuming that internet connection is located on the upper floor to improve universality.
- A repeater is installed considering the shielding on the B1F, to communicate with the endpoint and camera at the EV charging station to construct an alternative wireless system.

■ Final results and implementation

- Checked payment, IP phone call, and video quality to find out the threshold level which the system could be operated.

■ Quantitative effects

- Even in areas where LTE communication is unstable, cameras, IP phones, and payment systems can be operated with no running cost.

Repeater		End point		Camera	
RSSI	throughput	RSSI	throughput	RSSI	throughput
-60dBm	967 Kbps	-82dBm	594 Kbps	-86dBm	389Kbps

Wi-Fi HaLow is best replacement for vertical wiring in buildings, underground, etc., and covering areas LTE insensitive zone.

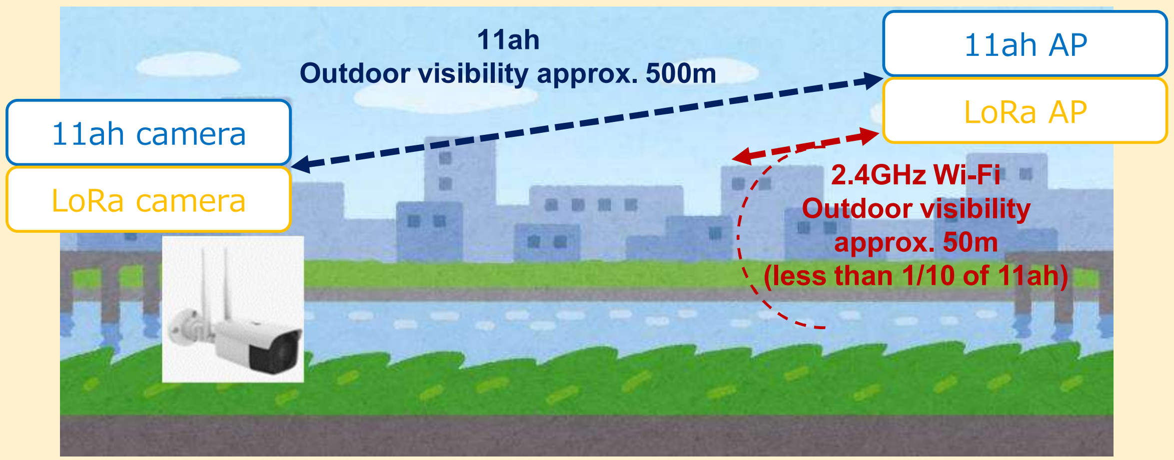
Use Case ⑤ Preventing disaster measure
Realistic local disaster prevention measure using video by local governments

■ Demonstration overview
- Improving the efficiency of river monitoring (improving accuracy of situation monitoring・reducing patrols)

■ Purpose of the demonstration
- Requiring patrols as there are many river flooding sites near urban areas.
- The water level can be monitored day and night with high-resolution images with 11ah.
- Monitor water level at risky flooded area remotely on a regular basis to reduce the patrol by staff.

■ Photo Performance comparison LoRa vs. 11ah

■ Demonstration image



■ Challenges and their countermeasures for the demonstration
- The image quality of water surface is unclear to determine detailed with LoRa camera image quality × transmission frequency.
- Compared the performance of LoRa and 11ah under the heavy rain environment with cooperation of the local government.
- Evaluated image visibility, transmission interval, etc. at a distance of approx. 500m from each AP.

■ Final results and implementation
- As a result of comparison, the difference of image quality including at night is obvious and the transmission interval is ideal for actual operation in river monitoring.
- High evaluation of the 11ah camera's visibility at night by the local government.

■ Quantitative effects（Performance comparison LoRa vs. 11ah）
- 11ah system can send HD size video, about 12 times the number of pixels, where LoRa could only send QVGA video over time.
- It is possible to send images at 20 times the transmission interval of LoRa.

Wi-Fi HaLow can fully solve the obvious issues and needs by conventional LPWA.

AHPC 802.11ah推進協議会

Activities to development and expand the Wi-Fi HaLow market

Current issues and Development of activities to solve them

① Expansion of frequency used and deregulation

→ 850MHz band use (no 10%duty restriction、output power up)

② Infrastructure Development

→ Ministry of Internal Affairs and Communications
”Regional Digital Infrastructure Utilization Promotion Project”

③ Launch of Interconnection Project

→ Make full use of vLab’s function and environment

Future Outlook

① Closer alliance activities with CIAT/ITRI

→ Expansion of 11ah adoption by Taiwanese vendor products entering the Japanese market

② Organize seminar, exchange information, joint trials

→ 11ah awareness and market bottom-up, and expansion of adoption through field trials

③ Event collaboration at COMPUTEX、AIoT Expo、CCD2024, etc.

→ 11ah marketability appeal by introducing products and use cases to Taiwanese companies