

Location: Taiwan

# High-Speed Cellular Network for an Electronic Toll Collection System

## Application:

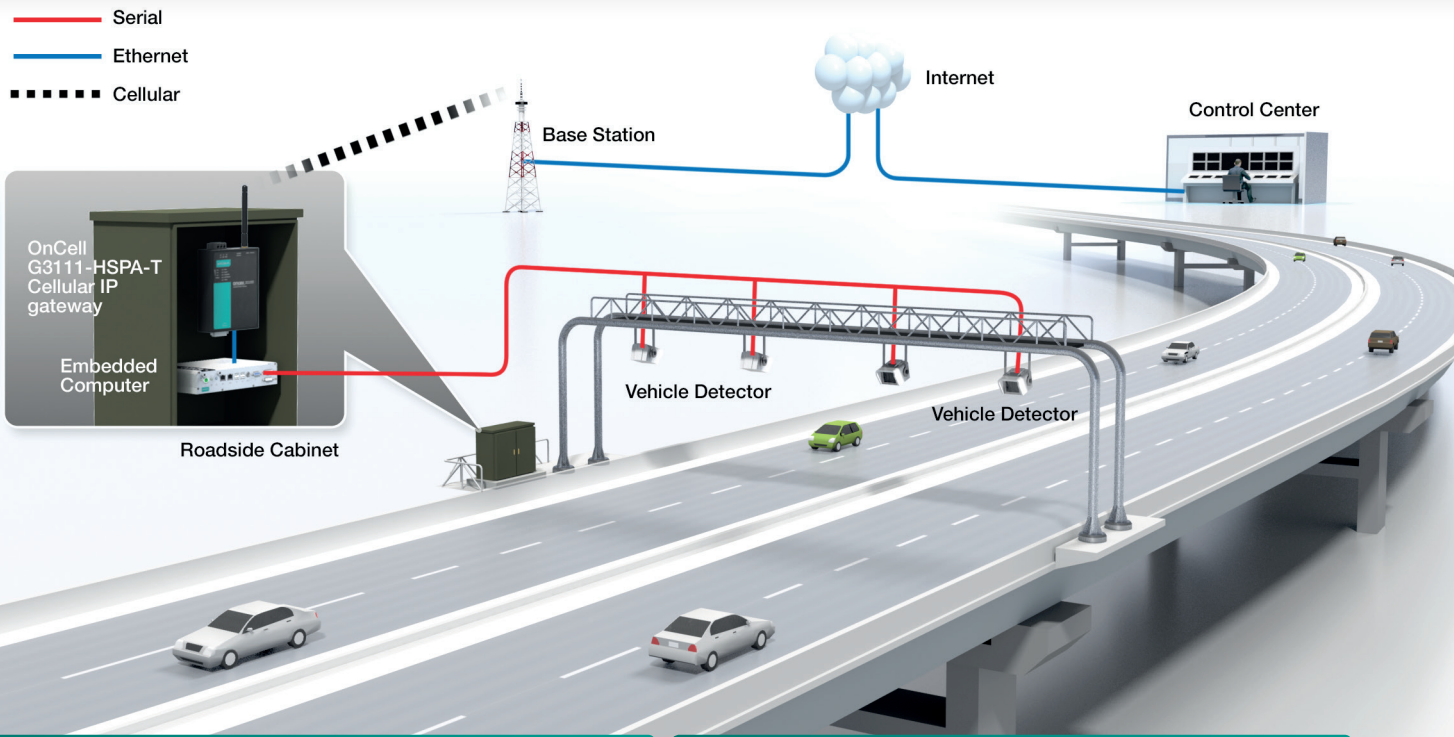
Electronic Toll Collection

## Customer Needs

- Withstand the high temperatures generated by several pieces of electronic equipment operating inside a small cabinet
- UL-certified cellular products to meet safety requirements
- Compact dimensions for installation on a gantry

## Moxa's Advantages

- -40 to 75°C operating temperature range to handle extreme temperatures inside the cabinet
- UL-certified to ensure device safety
- Palm-sized design to fit in applications with space constraints



## Project Background

An Electronic Toll Collection (ETC) system allows drivers to pay tolls without stopping at toll booths, thus eliminating the delays frequently experienced on toll roads without an ETC system. When a vehicle enters the toll road, sensors installed on top of the gantry detect the transponder or GPS device installed in the vehicle, and then use the vehicle's ID to automatically debit the vehicle's account.

A road operator company in Taiwan implemented ETC systems on highways not only for toll collection, but also for vehicle detection. Once the data collected by an ETC system has been processed by the system's computers, the cellular network forms the communication link between the ETC system and the control center. The ETC equipment needs to be installed in small cabinets located along the highway and must be able to withstand the extreme temperatures generated by the electronic equipment installed inside the steel cabinets.

## System Requirements

- A wide operating temperature range to ensure network reliability
- UL-certified cellular device to ensure smooth ETC system operation
- Compact design to fit inside a small roadside cabinet

## Moxa's Solution

Traditional toll plazas are expensive due to the initial construction costs as well as the ongoing labor costs of staffing the booth. However, the biggest problem is that the toll plazas become traffic bottlenecks for many highway systems. So, instead of renovating old toll plazas, many governments have chosen to construct ETC gantries to improve traffic flow by making toll collection more efficient. The road operator company that helped the Taiwanese government implement ETC systems across different highways in Taiwan used Moxa's OnCell G3111-HSPA cellular IP gateway to transmit data from a vehicle's sensors back to the control center. With multiple vehicles entering the toll road at high speeds every second, network latency is unacceptable. Moxa's 3G cellular gateway ensures that sufficient bandwidth is available for data communications at every gantry.

The ETC equipment is installed in roadside cabinets located along different highways in Taiwan. Since the OnCell G3111-HSPA-T supports operating temperatures from -40 to 75°C it is able to withstand the 60°C that is frequently experienced inside the cabinets due to the combination of the tropical weather in Taiwan and the heat generated by several devices operating inside a compact steel cabinet. Even though several pieces of ETC equipment are housed inside each cabinet, our cellular gateway's palm-size compact design makes it the ideal product to be used for space limited applications.

## Benefits

- Supports 3G technology to provide a high speed cellular network for data transmissions
- -40 to 75°C operating temperature range to ensure network reliability under harsh outdoor environments
- Palm-sized device able to fit in space restricted cabinets
- UL-certification ensures that the cellular device is suitable for ETC operations



## Related Products



### OnCell G3111-HSPA-T

Industrial five-band GSM/  
GPRS/EDGE/UMTS/HSPA  
cellular IP gateway

[http://www.moxa.com/product/OnCell\\_G3111\\_G3151-HSPA.htm](http://www.moxa.com/product/OnCell_G3111_G3151-HSPA.htm)

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# MOXA®

Reliable Networks ▲ Sincere Service



Location: Lithuania, Europe

# Reliable Cellular Connectivity for Real-Time Traffic Monitoring in Lithuania

## Application:

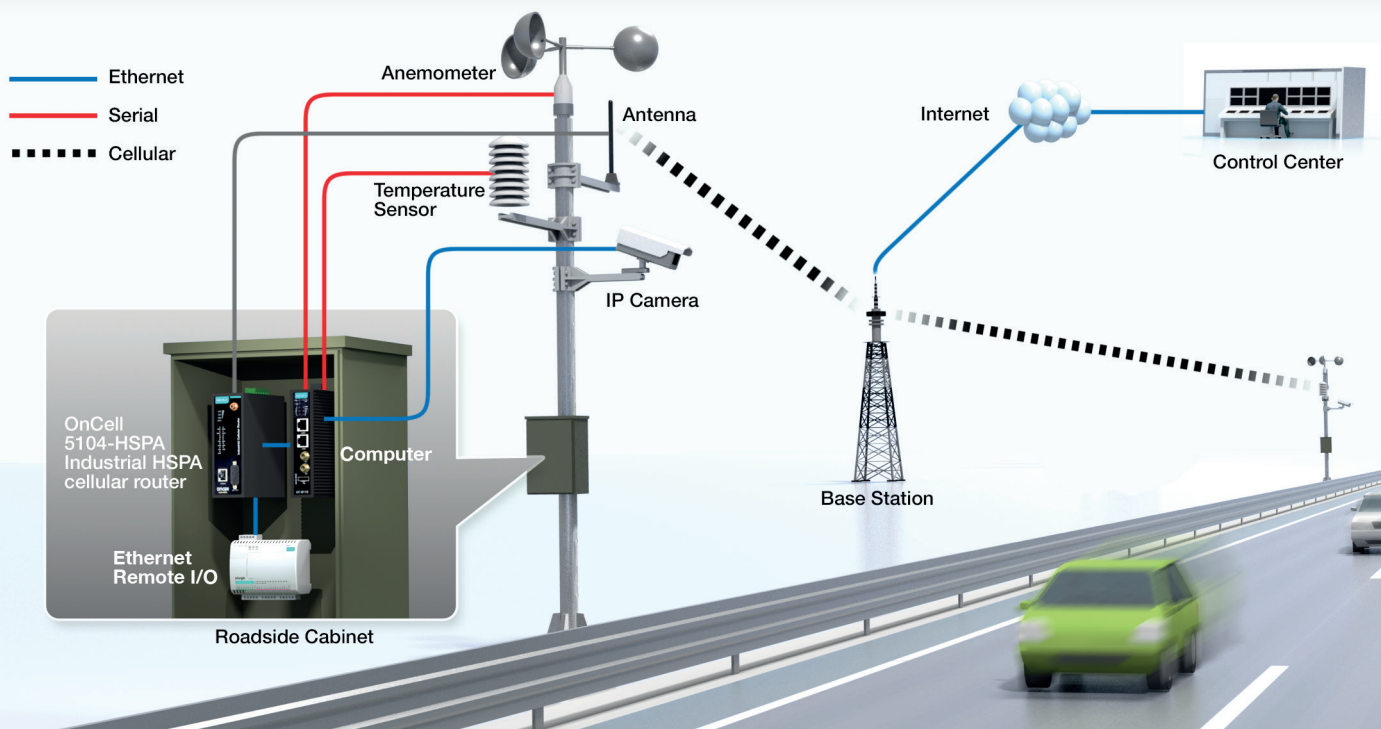
Advanced Traffic Management System (ATMS)

## Customer Needs

- High-bandwidth cellular solution for data and high-quality image transmission
- Requires multiple LAN ports on built-in cellular devices to connect several devices in a confined space
- Redundant mechanism to deliver real-time traffic information back to the control center

## Moxa's Advantages

- 3G HSPA technology provides data rates up to 14.4/5.76 Mbps (download/upload), ensuring smooth data and image transmission
- Four 10/100 Mbps built-in LAN ports that enable data communications with multiple devices located in a small roadside cabinet
- Dual-SIM card feature provides a backup option in case one link fails so that continuous transmissions are not interrupted



## Project Background

To improve traffic flow and reduce the occurrence of unexpected incidents, road operators usually implement an Advanced Traffic Management System (ATMS) to collect real-time traffic information and weather conditions. Moxa's customer Skaidula, an intelligent transportation system integrator, helped the Lithuanian road administration develop the network backbone for their ATMS to collect and transmit critical data, including road weather conditions and traffic status images captured by cameras. By collecting this data, road operators can provide real-time information to drivers, allowing them to avoid incidents, such as traffic jams, roadwork, or accidents, which could increase their journey time.

To ensure real-time transmissions, a reliable and high-bandwidth cellular solution is required for transmitting both data and images from over 500 road spots throughout Lithuania. Moreover, the roadside cabinet has a limited space for device installation, so it requires a cellular product able to connect with multiple Ethernet-based devices.

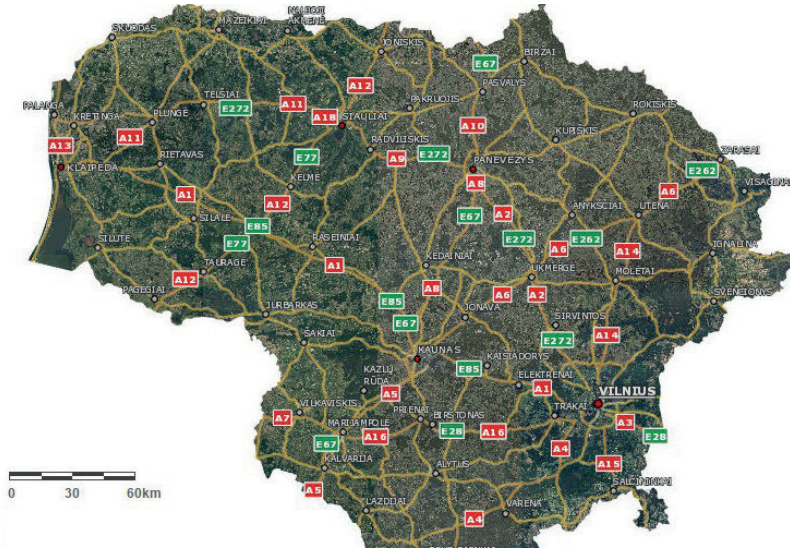
## System Requirements

- Large bandwidth requirement for cellular products to transmit data and images back to the traffic control center
- Able to connect with multiple Ethernet-based devices in a space-limited roadside cabinet
- Smart redundant mechanism to avoid packet loss when the cellular link is down

## Moxa's Solution

The Lithuania road administration has its own ATMS to provide real-time traffic and weather conditions to drivers. The system integrator Skaidula chose Moxa's OnCell 5104-HSPA to develop a high-bandwidth and reliable cellular network. Over 500 OnCell devices have been deployed by the roadside in Lithuania to collect two types of data: weather information and images displaying traffic conditions. The weather information collected includes wind direction, wind speed, and temperature, which are logged into the database every two minutes. Images captured by cameras are sent back to the control center every 15 minutes to allow real-time monitoring of traffic conditions. In addition to collecting information, operators can also connect to cameras over a cellular network to view live video streams when emergencies occur. To ensure smooth video streaming and that both sets of information are sent back to the control center, our OnCell 5104-HSPA supports data rates of up to 14.4/5.76 Mbps (download/upload). Moreover, the OnCell has a dual-SIM-card design for backing up data if one of the links goes down, providing reliable cellular connectivity for real-time traffic monitoring.

The entire system was installed inside a small cabinet mounted on a roadside pole. The system



Real-time traffic monitoring covers the main roads in Lithuania.

includes one computer used to collect and process all the weather and traffic information, and one remote I/O device used to monitor system operation by collecting different types of data, including internal cabinet temperature, battery charging or discharging voltage, door opening, and power line status. The OnCell 5104-HSPA supports four 10/100 Mbps LAN ports that can connect both the computer and remote I/O device, ensuring smooth communication with the control center over the cellular network.

## Benefits

- Data rates up to 14.4/5.76 Mbps (download/upload) supported by HSPA technology, ensuring high-speed transmission for both data and images
- Four 10/100 Mbps LAN ports in one cellular device to connect multiple devices inside a small cabinet
- Dual-SIM-card design for cellular link redundancy by providing a backup option when one link goes down



## Related Products



### OnCell 5104-HSPA

Industrial five-band GSM/GPRS/EDGE/UMTS/HSPA cellular routers

[http://www.moxa.com/product/OnCell\\_5004\\_5104-HSPA.htm](http://www.moxa.com/product/OnCell_5004_5104-HSPA.htm)

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Location: Las Vegas, USA

# High-Speed Video Transmission over IEEE 802.11n WLAN for Bus Surveillance System

## Application:

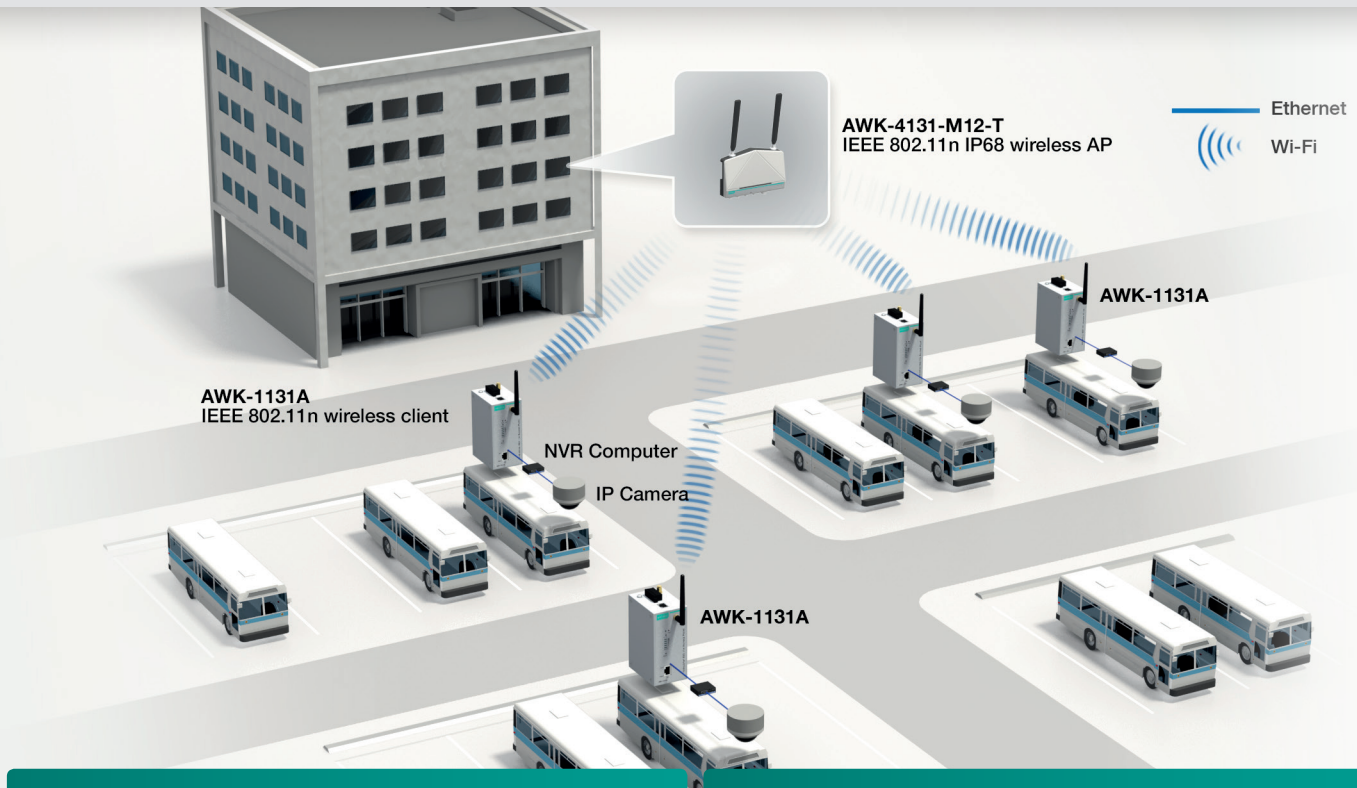
High-speed transmission for wireless video uploads at a bus depot

## Customer Needs

- Sufficient bandwidth to upload high-definition videos via a wireless connection
- Wide wireless coverage to ensure continuous Wi-Fi access at the bus depot
- Wireless devices that can operate under extreme environmental conditions in the desert

## Moxa's Advantages

- IEEE 802.11n compliant wireless devices that provide data rates of up to 300 Mbps
- MIMO (multiple-input multiple-output) technology support ensures wireless coverage at a bus depot
- Devices with wide operating temperature range (-T models only) and IP68 rating (AWK-4131 only) for outdoor protection



## Project Background

A transportation company in Las Vegas serves thousands of travelers each day, across well over 100 routes each week, with approximately 200 buses operating from a bus depot. The administration wanted to implement an intelligent surveillance system that can provide video recordings of standard quality during normal operating conditions and that can switch to high-definition (HD) video footage when an emergency arises. With multiple surveillance cameras installed throughout each bus, video surveillance is captured at 300 DPI under normal conditions. However, when an emergency situation is identified by the bus driver, the quality of the pertinent video will increase from 300 DPI to 720 DPI (HD) to provide enhanced imagery of the incident for durations of 10 minutes before and 10 minutes after the incident occurred. A wireless device that can support high bandwidth is required to ensure that the footage stored on the onboard NVR can be extracted via a reliable wireless connection when the vehicle returns to the depot.

## System Requirements

- Sufficient network bandwidth to upload high-definition videos from the bus via a wireless connection to the depot command center
- Wireless access points installed at the depot control center must be able to provide wireless coverage for every bus in the bus depot
- Wireless access points must be able to withstand the drastic changes between day and night temperatures in the desert

## Moxa's Solution

Aboard each bus, video footage captured by the vehicle is stored on an onboard NVR. When an unexpected incident/emergency is identified by the bus driver, image quality is immediately increased from 300 DPI to 720 DPI for a duration of 20 minutes, and the video footage is stored on the onboard storage drive. Control room operators at the bus depot will then be notified of the recorded events and will process requests for wireless transfer of video data when the bus arrives at the depot. The file size for 20 minutes of 720-DPI video is approximately 200 MB.

For this high-bandwidth wireless application, an AWK-1131A IEEE 802.11n wireless client was installed in each bus to provide up to 300 Mbps data rate transmission for sending the onboard video footage to the control center. When the bus is parked at the depot, the onboard wireless devices will connect with the IP68-rated AWK-4131 access points attached to the outer wall of the control center building, to maintain high-speed 802.11n wireless connections using MIMO capabilities, and to reach data transfer speeds of up to 300 Mbps. The huge difference between day and night temperatures at the depot have the potential to damage outdoor wireless devices. However, the AWK-4131's IP68-rated waterproof housing, which can withstand temperatures between -40 and 75°C, protects the wireless devices from harsh conditions to guarantee continuous, reliable wireless connections.

## Benefits

- Up to 300 Mbps data rate to provide efficient transfer of 720-DPI video footage from the onboard NVR to the control center
- IEEE 802.11n MIMO technology maximizes wireless coverage to ensure that wireless clients on buses will have uninterrupted Wi-Fi access
- -40 to 75°C wide operating temperature range (-T model only) for extreme operating environments
- IP68-rated (AWK-4131 only) for outdoor protection against dust and rain to reduce maintenance efforts



## Related Products



### AWK-1131A

Entry-level industrial IEEE 802.11a/b/g/n wireless client

[http://www.moxa.com/product/AWK-1131A\\_Series.htm](http://www.moxa.com/product/AWK-1131A_Series.htm)



### AWK-4131-M12-T

Outdoor industrial IEEE 802.11a/b/g/n wireless AP

[http://www.moxa.com/product/AWK-4131\\_Series.htm](http://www.moxa.com/product/AWK-4131_Series.htm)

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# MOXA®

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 Location: **Across Europe**

# High-Bandwidth Network for a High-Speed Passenger Train in Europe

## Application:

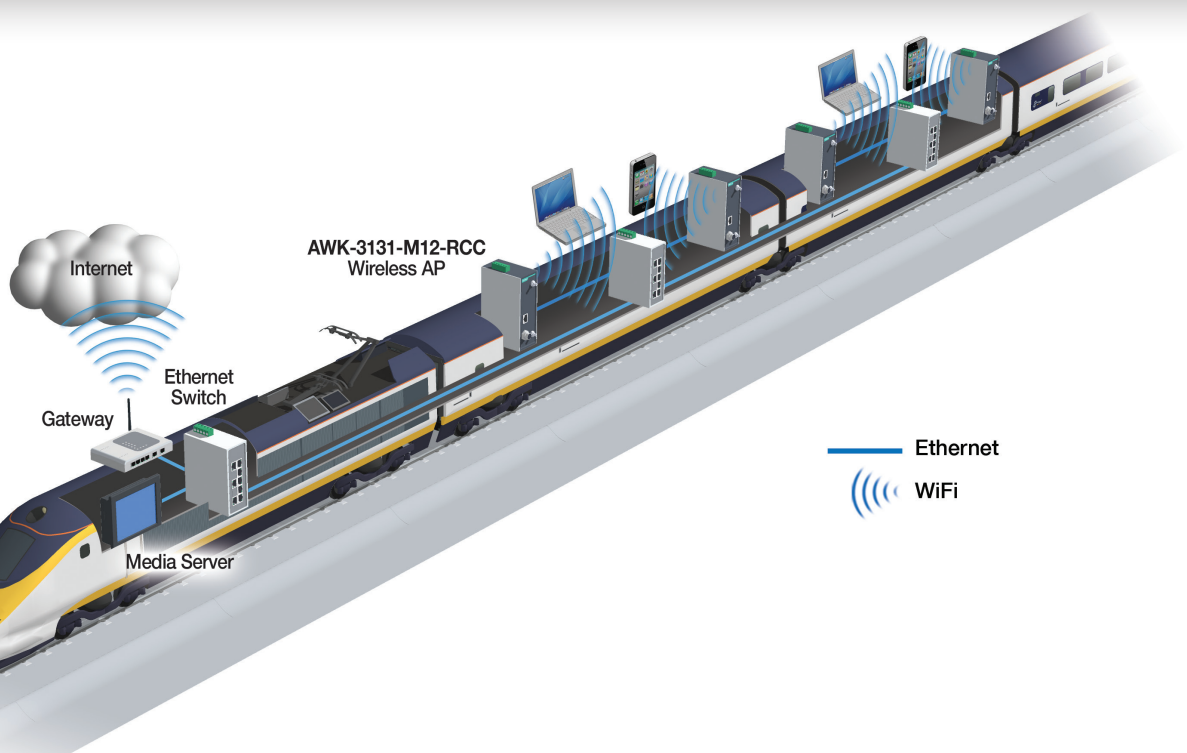
Passenger Wi-Fi Access

## Customer Needs

- Sufficient bandwidth and smooth Wi-Fi access for all passengers in every carriage
- Flexible wireless backbone network for inter-carriage communications
- Network devices that can withstand harsh onboard environments

## Moxa's Advantages

- Supports up to 150 Mbps throughput
- Seamless Internet access for 50 concurrent clients per AP at 2 Mbps
- Automated Carriage Connection technology for easy inter-carriage connections
- Compliant with essential sections of EN 50155 related to protection against surge, vibration, and EMI



## Project Background

Uninterrupted wireless Internet access is essential for passengers who want to stream HD videos, and enjoy Video on Demand (VOD) services through their mobile devices. A high-speed passenger train company in Europe wanted to deploy a network that could provide smooth wireless access to every passenger on the train. To achieve this level of service, the operator must first perform a network bandwidth calculation to ensure that the wireless link can provide enough bandwidth to serve a large number of smart phones, tablets, and laptops, to provide every passenger on the train with the best Wi-Fi experience.

In addition, the provider must ensure that the infotainment service and Wi-Fi hotspots are available in every carriage throughout the train, which requires a reliable and flexible wireless backbone network for inter-carriage communication. Last but not least, this network must be able to withstand the harsh onboard railway environment, and the wireless devices must be rugged products that can work reliably day in and day out.

## System Requirements

- A network that can provide sufficient bandwidth for around 100 passengers in each carriage
- An automated inter-carriage wireless connection to ensure network availability when train carriages are rearranged
- Network devices that can withstand harsh onboard conditions such as constant vibration and electrical disturbances

## Moxa's Solution

The purpose of the new infotainment system was to provide more bandwidth to allow all passengers to access more media content, thereby creating a better onboard experience for the passengers. The design goal was that each AP would be able to simultaneously provide sufficient bandwidth for 50 Wi-Fi clients. For example, when 50 passengers in one carriage are streaming HD videos, each requires around 2 Mbps of bandwidth for continuous lag-free streaming, so each AP must be able to support a bandwidth of at least 100 Mbps. To serve almost 100 passengers in one carriage, the train required two AWK-3131-M12-RCC wireless APs per carriage that support the 802.11n standard capable of providing 150 Mbps throughput. Moreover, to avoid overloading a single AP, the wireless APs should also have load-balancing capability so that every passenger can experience uninterrupted network connectivity.



Moxa lab test using numerous smart phones and tablets.

The AWK-3131-M12-RCC is compliant with the essential parts of railway certifications relating to the ability to withstand severe vibration and electrical disturbances such as EMI and power surges, ensuring uninterrupted wireless communications throughout the journey. Moreover, to provide a reliable and flexible wireless backbone network, the AWK-3131-M12-RCC supports the Automatic Carriage Connection (ACC) feature that makes inter-carriage wireless backbone topologies easy to maintain. The ACC feature provides automatic reconnection and configuration capabilities, so that operators do not have to worry about the wireless backbone network when train carriages are interchanged. ACC also reduces the maintenance effort required and eliminates configuration errors that could occur when the train's carriages are rearranged.

## Benefits

- Up to 150 Mbps of network bandwidth that ensures concurrent video streaming for 50 customers per AP
- Automatic Carriage Connection technology ensures a reliable and flexible wireless backbone network that makes maintenance easy when carriages are replaced
- Adheres to the EN 50155 railway standard for harsh trackside and onboard environments



## Related Products



### AWK-3131-M12-RCC-T

Industrial IEEE 802.11a/b/g/n wireless AP

<http://www.moxa.com/product/AWK-3131-RCC.htm>

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Location: **Japan**

# Smart Wireless Sends Warehouses Into Smart Territory

## Application:

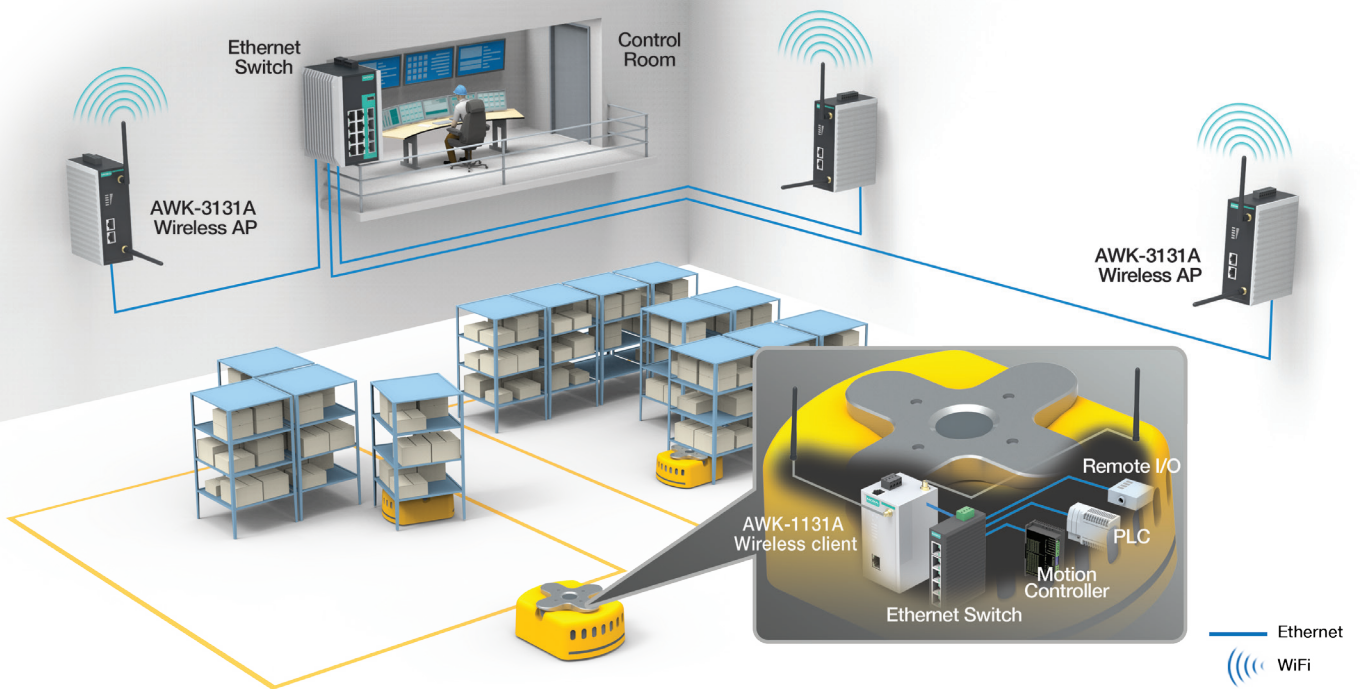
Automated Guided Vehicles

## Customer Needs

- Fast roaming time under 200 milliseconds
- The ability to configure roaming sensitivity to adapt the same solution in different-sized factories
- Industrial-grade design to withstand harsh environments

## Moxa's Advantages

- Turbo Roaming supports 150 ms roaming time
- The ability to adjust roaming parameters to fulfill different roaming requirements
- Dual isolation protects power and RF ports from inrush current interference



## Project Background

Many Automated Materials Handling (AMH) systems have been implemented in factories to increase productivity. AGV systems are a common AMH system used in factory logistics to enhance operational accuracy and efficiency. One of our customers in Asia, who provides logistics services, wanted to deploy AGV systems in warehouses. Their aim was to provide real-time goods delivery so that their customers could achieve zero inventories in retail stores.

These AGV systems rely on wireless networks to communicate with a control center. Any single point of device failure interrupts wireless connections, which leads to goods delivery delays and increased operation costs. To take advantage of AGV systems, the wireless device must be reliable and rugged enough to provide seamless wireless communication while AGVs are on the move.

## System Requirements

- Seamless roaming ability is a must to ensure wireless connections between different access points (APs) when AGV systems move around inside warehouses
- The ability to allow users to adjust the roaming parameter to adapt to the requirements of different deployment venues
- Isolation design to protect wireless devices from inrush current interference generated by motors on AGV systems
- Anti-vibration design to ensure continuous wireless device operation under constantly moving conditions

## Moxa's Solution

Reliable wireless networks are required to enable AGV systems in warehouses. Different requirements from APs and clients (devices) determine the formation of a reliable wireless network. In this case, AWK-3131A wireless devices have been used as APs to provide Wi-Fi coverage. The AWK-3131A supports 802.11n with 2x2 MIMO antenna output, allowing a wider coverage of Wi-Fi communication. Furthermore, it provides sufficient bandwidth with a 300 Mbps data rate, keeping your options wide open for possible future system expansions. With 5 GHz channel support, AGV systems can operate in a cleaner environment than under the over-saturated 2.4 GHz frequency. As the ideal wireless client in an AGV system, the AWK-1131A wireless device offers three benefits: compactness, ruggedness, and mobility.

Moxa's small-sized AWK-1131A is the perfect solution for space-limited vehicle systems that need compact wireless devices to fit easily into an AGV system. The AWK-1131A has a rugged design that can endure harsh, onboard conditions, and it provides both power and antenna port isolation to prevent unexpected electrical interference. For example, when a wireless device shares the same power source with motors, wireless communication can easily be interrupted due to inrush current generated by the motors. With 500-volt insulation on power ports and level-4 ESD on antenna ports, a wireless device can isolate any unwanted electrical charges.

More importantly, optimized device mobility is the major concern for AGV systems. The AWK-1131A supports client-based Turbo Roaming technology that provides 150 ms handoff times between APs to enable seamless mobile operations for warehouses.

## Benefits

- Turbo Roaming's millisecond-level handoff times ensure seamless AGV system operation while on the move
- A configurable roaming threshold to ensure reliable roaming performance in different-sized venues
- With 500-volt insulation on power ports and level-4 ESD on antenna ports, AGV systems can withstand electrical interference, for worry-free integration
- A throughput rate of up to 300 Mbps and 2x2 MIMO technology to maximize Wi-Fi coverage for shuttle systems
- Anti-vibration design meets the IEC 60068-2-6 standard, protecting wireless communications under constant motion



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## Related Products



### AWK-3131A

Industrial IEEE 802.11a/b/g/n wireless AP

<http://www.moxa.com/product/AWK-3131A.htm>




### AWK-1131A


Entry-level industrial IEEE 802.11a/b/g/n wireless client

[http://www.moxa.com/product/AWK-1131A\\_Series.htm](http://www.moxa.com/product/AWK-1131A_Series.htm)

## Learn more



**White Paper**  
Five Critical Elements of Uninterrupted Wireless Connectivity for AS/RS and AGV Systems



[www.moxa.com/wireless-AGV-wp](http://www.moxa.com/wireless-AGV-wp)



**Microsite**  
Learn more about our wireless solutions on Moxa's website.



[www.moxa.com/wireless-AGV](http://www.moxa.com/wireless-AGV)



Location: China

# The Cold Storage Warehouse Where Wireless Doesn't Freeze Up

## Application:

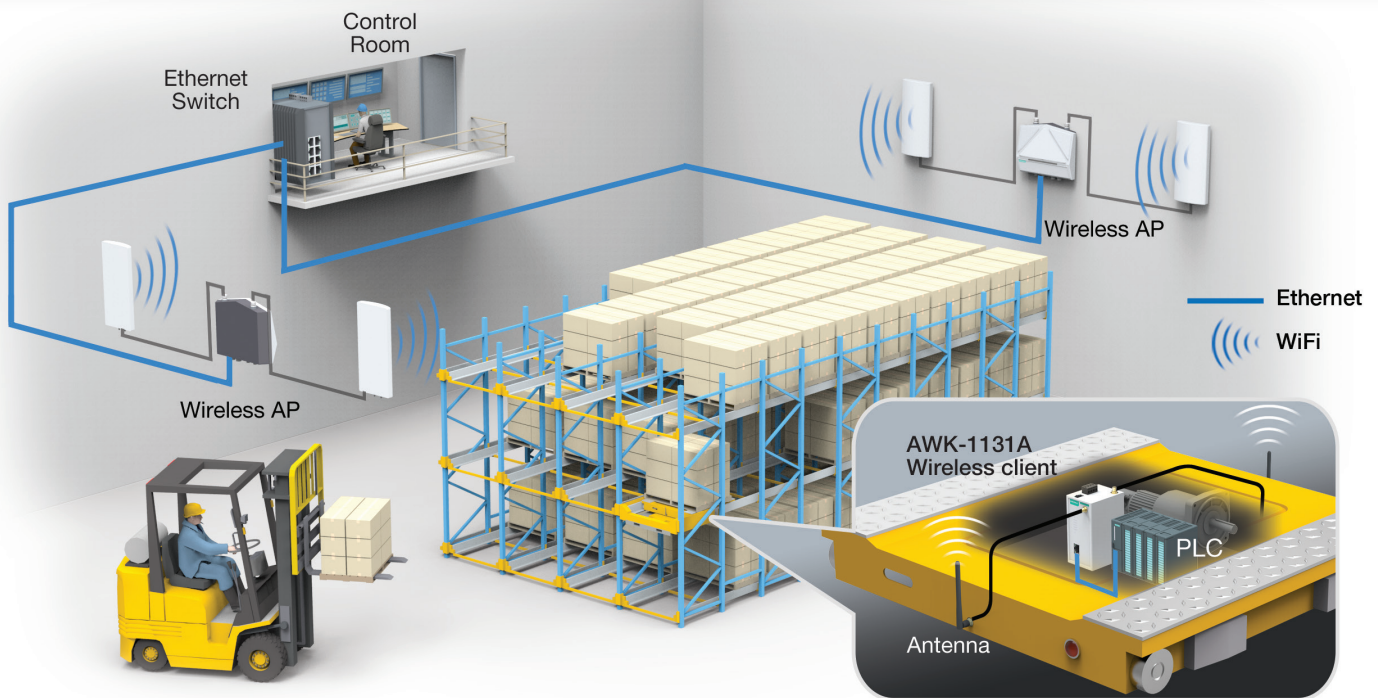
Automated Storage/Retrieval Systems

## Customer Needs

- Withstand low temperatures in a cold storage warehouse
- A small device to fit in limited spaces on shuttle systems
- Fast roaming performance for nonstop operations

## Moxa's Advantages

- Capable of operating at -40°C
- Compact but sturdy design to deliver supreme performance in limited spaces
- Turbo Roaming supports 150 ms handover time



## Project Background

An automated storage and retrieval system (AS/RS) is a smart system used in warehouses to enhance the efficiency of storage processes. This AS/RS features a shuttle-storage-shelving design that automatically moves goods up and down and back and forth between shelves, eliminating the possibility of human error. An AS/RS manufacturer in China helped a food company develop a smart storage warehouse to store fresh food at low temperatures. The application required a reliable wireless network.

At the heart of the constantly mobile equipment are wireless devices that enable communications between the control center and the large number of shuttle systems. As these shuttle systems have limited space to carry a large number of devices, the wireless apparatus has to be small but rugged in design to ensure seamless operations.

## System Requirements

- Maintain normal operation even in sub-zero temperature environments
- Small-sized wireless devices mounted in space-limited shuttle systems
- Fast handover time to ensure real-time control and monitoring of shuttle systems
- Full wireless coverage on shuttle systems to stay connected with the control center
- Isolation design to protect wireless devices from electrical interference generated by motors on the shuttle systems

## Moxa's Solution

An AS/RS makes it easy to store and retrieve goods and increases productivity compared with manual processes. The success of an AS/RS depends heavily on the deployment of reliable wireless devices throughout a network. To ensure that the shuttle systems in an AS/RS operate at peak performance, Moxa's AWK-1131A wireless devices offer three benefits: a compact but rugged design, seamless roaming ability, and greater wireless coverage.

The rugged, palm-sized AWK-1131A was designed to keep wireless operations stable in harsh industrial environments, including cold storage warehouses in which the temperature could get as cold as -40°C, and to fit comfortably in space-restricted shuttle systems. Moreover, the AWK-1131A has power and RF isolation built in to protect wireless devices from electrical interference generated by motors. These two design features save space and eliminate the cost of installing extra isolator accessories.

Roaming performance is always an essential feature of wireless devices. The AWK-1131A series has client-based Turbo Roaming technology that offers millisecond-level handover times to ensure that client devices on shuttle systems can always connect with access points (APs), which increases productivity by ensuring that shuttle equipment can move smoothly between shelves.

Finally, the AWK-1131A supports the 802.11n standard to offer a throughput rate of up to 300 Mbps and MIMO technology to maximize wireless availability in shuttle systems. Installing an antenna on both the front and back of the shuttle system ensures seamless connections with APs mounted on the wall. Moreover, the 5 GHz channel offers a low-traffic channel for wireless communications to avoid unexpected timeout due to oversaturated channel usage.

## Benefits

- The ability to operate at -40°C ensures nonstop operations in cold storage warehouses
- Palm-sized design to save space in space-limited shuttle systems
- Turbo Roaming's millisecond-level handoff times ensure seamless shuttle system operations
- With 500-volt insulation on power ports and level-4 ESD on antenna ports, AGV systems can withstand electrical interference, for worry-free integration
- A throughput rate of up to 300 Mbps and 2x2 MIMO technology to maximize Wi-Fi coverage for shuttle systems



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## Related Products



### AWK-1131A-T

Entry-level industrial IEEE 802.11a/b/g/n wireless client

[http://www.moxa.com/product/AWK-1131A\\_Series.htm](http://www.moxa.com/product/AWK-1131A_Series.htm)

## Learn more

**White Paper**  
Five Critical Elements of Uninterrupted Wireless Connectivity for AS/RS and AGV Systems

[www.moxa.com/wireless-AGV-wp](http://www.moxa.com/wireless-AGV-wp)

**Microsite**  
Learn more about our wireless solutions on Moxa's website.

[www.moxa.com/wireless-AGV](http://www.moxa.com/wireless-AGV)



Location: **Taiwan**

# Deploying High-Speed Cellular Networks for Feeder Terminal Unit (FTU) Automation

## Application:

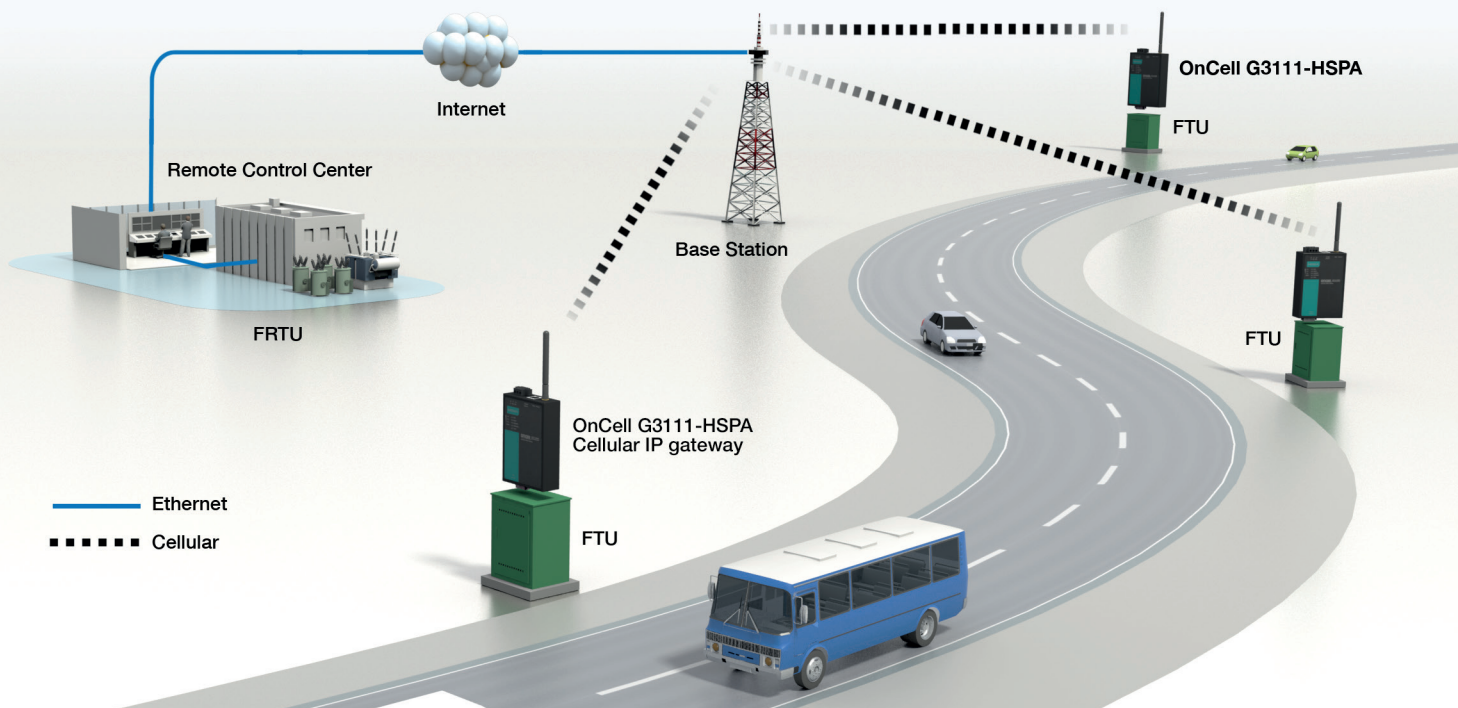
FTU Monitoring

## Customer Needs

- TCP/IP-based connections between the feeder remote terminal units (FRTUs) and the FTUs without the need to install additional software thereby reducing R&D and maintenance costs
- A reliable cellular network to ensure that the FRTUs receive notifications from the site when any of the FTUs in the network goes down
- Both serial and Ethernet ports to connect devices with different interfaces

## Moxa's Advantages

- A solution that can provide reliable TCP/IP-based connection between the FRTU and FTUs at a site without the need to install additional software
- GuaranLink technology ensures reliable cellular connectivity between the FTUs and the FRTUs
- Both serial and Ethernet ports for flexible deployment of sensing equipment at the FTUs



## Project Background

Since power plants are often located far from the population centers they serve, electricity needs to be transmitted across long distances at a high voltage. Power lines deliver electricity from the plant to the power substations, where it is converted to a lower voltage before being distributed to the local community. The feeder terminal units (FTUs) monitor I/O statuses by collecting and processing digital and analog data at each site. An electric power utility company in Taiwan divided its power grid into several districts. Each district consisted of several FTUs that are connected in a ring topology and monitored by an FRTU. A reliable IP-based cellular gateway is required at each FTU to ensure smooth cellular connectivity for sending notifications to the FRTU whenever one of the FTUs goes down.

## System Requirements

- An IP-based solution to enable reliable TCP/IP communication between the FRTUs and the FTUs
- Self-healing technology for prompt recovery of the monitoring network when an FTU goes down
- Both serial and Ethernet ports to accommodate devices with different interfaces

## Moxa's Solution

Each FTU is constantly transmitting parameters, such as the fluctuating levels of electricity, to the local FRTU of that district. The FRTU usually communicates with FTUs through fiber connections. However, when an FTU is used at a hard-to-access location, it's too difficult or expensive to implement a wired connection. By taking advantage of the OnCell G3111-HSPA's ability to connect a serial device or an Ethernet device deployed in each FTU, Moxa also enabled the utility company to monitor all the districts in the power grid from a remote control center without the inconvenience and expense of constructing a new wired network.

As an additional safety mechanism, administrators are given the option of issuing commands to the FRTU to shut down a faulty FTU, effectively isolating the problem in order to protect the rest of the power grid. Since electricity is an important and essential service for the district, the communication link between the FTUs and FRTU must be reliable. In order to provide a fully functional self-healing network with immediate recovery function, the OnCell G3111-HSPA also comes equipped with GuaranLink technology, which ensures that the connection is always on to provide zero data loss and on-demand cellular communications.

## Benefits

- The IP-based cellular network fully automated the monitoring system without the need to reconfigure TCP/IP settings
- GuaranLink technology provided uninterrupted cellular communication so that the FRTU can immediately isolate an FTU (when it fails) thereby improving the reliability of the power transmission network, shortening the outage time, and considerably reducing the scope of the damage
- Both serial and Ethernet ports were available for easy deployment of devices at each FTU



## Related Products



### OnCell G3111-HSPA

Five-band GSM/GPRS/  
EDGE/UMTS/HSPA IP  
gateway for serial-over-  
cellular (RS-232) or  
Ethernet-over-cellular (RJ45)

[http://www.moxa.com/product/OnCell\\_G3111\\_G3151-HSPA.htm](http://www.moxa.com/product/OnCell_G3111_G3151-HSPA.htm)



Location: USA

# Secure Wireless Communications for Connecting Fracturing Trucks

## Application:

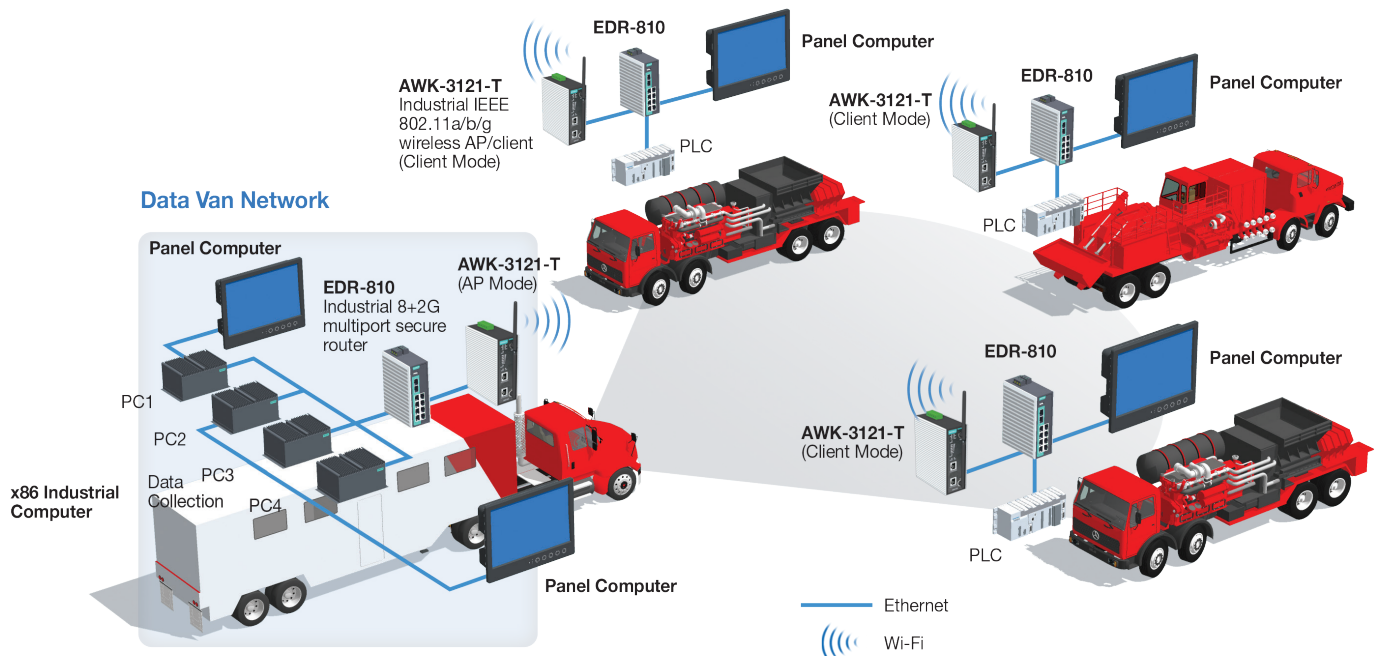
Oil Extraction with Fracturing Trucks

## Customer Needs

- Equipment must be able to withstand hazardous conditions at fracturing sites
- Requires a flexible and reliable wireless network to ensure seamless connectivity
- A secure network for PLC devices that can transmit and receive error-free data

## Moxa's Advantages

- Compliant with UL/cUL Class I Division 2, ATEX Zone 2 certifications
- An autoconfiguration function to ensure that any client device can switch to an access point (AP) when a primary AP is not available on a data van
- A secure router to provide deep packet inspection to eliminate unsafe data



## Project Background

Some oil and gas applications require fracturing trucks to extract oil from shale. A fracturing service company has a fleet of trucks that they rent to oil extraction operators. Traditionally, wired cables are used to enable communications between the trucks and data vans at the site, but these cables often break or get cut, and they are very expensive to replace. For this reason, the fracturing service company decided to look into wireless options.

The ideal wireless device must provide a reliable and flexible network, allowing fracturing trucks to communicate with mobile data vans that collect data. In addition, a highly secure network that does not limit data transmission bandwidth is required to ensure that critical devices on the trucks and data vans can transmit and receive data error free.

## System Requirements

- Must be able to withstand extreme temperatures and hazardous conditions at fracturing sites
- Flexible wireless networks that can replace wired networks
- A secure network for PLC devices to transmit and receive data error free

## Moxa's Solution

Extracting oil at a fracturing site could potentially cause serious damage if the on-site devices are not protected properly. Our AWK-3121-T wireless AP/client and EDR-810-T secure router are compliant with UL/cUL Class I Division 2 and ATEX Zone 2 certifications; they will function reliably in extreme temperatures between -40 to 75°C, making them well suited for oil and gas environments.

Fracturing trucks communicate with a nearby data van to receive and transmit critical data. To streamline the network's transition from wired to wireless, operators replaced their cables with our AWK-3121-T wireless AP/client to form a reliable and flexible wireless network. Normally, a wireless AP on a data van provides wireless access to several wireless clients installed on fracturing trucks. To ensure continuous wireless communications, these wireless clients negotiate to determine which wireless client should be configured automatically into a wireless AP that provides wireless access when the original AP used on a data van is not available because it's busy with another task. The AWK-3121-T wireless AP/client's auto-configuration feature allows operators to continuously control and monitor fracturing sites over a wireless network, at any time of the day or night.

A PLC is installed on each fracturing truck to control the oil extraction process. To ensure error-free data communication between the control center and the PLCs, Moxa's EDR-810-T secure router, which supports deep packet inspection, is used to ensure that all of the data packets transmitted and received between the control center and the PLCs are safe.

## Benefits

- Compliant with UL/cUL Class I Division 2, ATEX Zone 2 certifications for oil extraction environments
- A -40 to 75°C wide operating temperature range for outdoor environments.
- An auto-configuration function ensures that wireless clients can be reconfigured automatically as APs when the primary AP is not available
- A secure router that supports deep packet inspection to ensure safety-critical data communications



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## Related Products



### AWK-3121-T

Industrial IEEE  
802.11a/b/g wireless  
AP/client

[http://www.moxa.com/product/AWK-3121\\_Series.htm](http://www.moxa.com/product/AWK-3121_Series.htm)



### EDR-810-T

Industrial 8+2G multiport  
secure router

<http://www.moxa.com/product/EDR-810.htm>

## Recommended Products



### AWK-3131A-T

Industrial IEEE  
802.11a/b/g/n wireless  
AP/bridge/client

<http://www.moxa.com/product/AWK-3131A.htm>



Location: South Africa

# Reliable Wireless Control and Monitoring for Autonomous Mining Equipment

## Application:

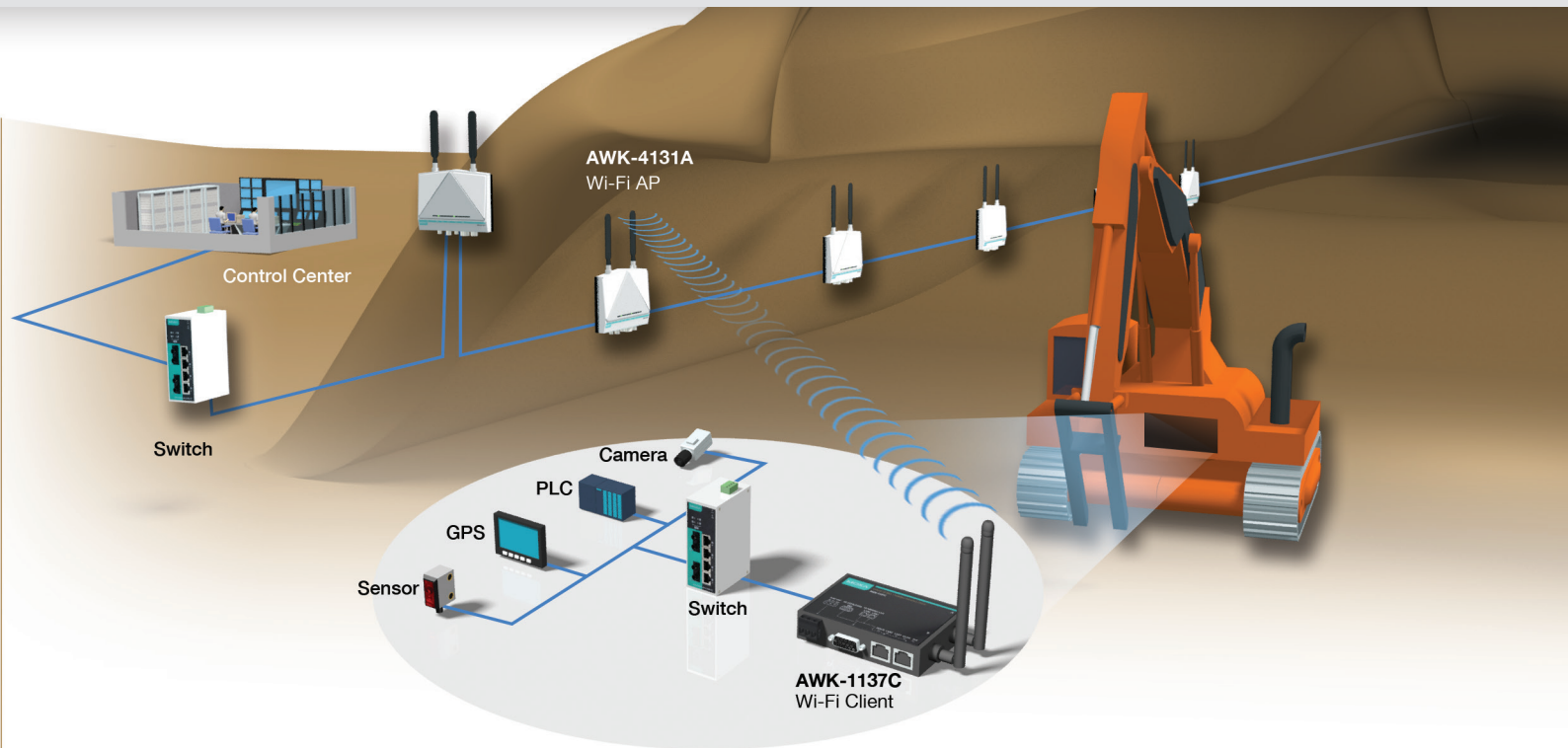
Autonomous Haulage  
Vehicles and Drilling Rigs

## Customer Needs

- Seamless communication in underground mines and tunnels
- Data collection from PLC installed on driverless vehicles
- Industrial-grade design to ensure reliable performance in harsh environments

## Moxa's Advantages

- Turbo Roaming technology to achieve millisecond-level handoffs (< 150 ms)
- Transparent connections to PROFINET devices in master/slave mode
- IP68-rated enclosure for harsh outdoor applications



## Project Background

Autonomous Haulage System (AHS) and drilling rigs are deployed in mines to improve operational safety and efficiency. Unmanned operations performed by autonomous drilling rigs, mining trucks, and loaders can reduce the number of operators and drivers working in hostile and remote conditions, thereby increasing operational safety, accuracy, and efficiency, and reducing personnel costs.

One of our global customers, who provides mining automation solutions, was aiming for a reliable wireless communication solution to enable their customers to achieve better productivity and management. These driverless drilling rigs, mining trucks and loaders rely on wireless network communications to enable operators to remotely control and monitor mining operations from the safety and comfort of their control rooms. To ensure real-time data communication, the wireless devices deployed must be reliable and rugged enough to provide seamless wireless communication while such unmanned rigs and vehicles are on the move.

## System Requirements

- Seamless roaming between access points (APs) is a must to ensure connectivity for clients onboard autonomous drills and haulage vehicles that move around inside underground tunnels
- The ability to communicate with multiple PROFINET-based devices transparently for real-time control
- Industrial-grade design to ensure reliable performance in harsh environments
- Anti-vibration design to ensure continuous wireless device operation under continuous mobile conditions



## Moxa's Solution

A reliable and robust wireless network is required in underground mining tunnels to enable machine operators to remotely control and monitor drilling rigs, mining trucks, and loaders. The wireless network must facilitate reliable real-time data communication between the unmanned mobile vehicles and the operator in the control center.

The equipment manufacturer installed Moxa's compact-sized industrial-grade AWK-1137C clients with an anti-vibration design on each of their drilling rigs and mining trucks to be able to remotely access them from the control room. These AWK-1137C clients operating in the slave mode enable transparent transmission of PROFINET traffic, including data and live video streams, to the control center through the wireless access network.

The AWK-1137C clients uplink large volumes of data and live video streams from each of these driverless vehicles to the operator station through the wireless access network. Most importantly, the AWK-1137C clients support Moxa's Turbo Roaming technology that provides fast roaming with handoff times under 150 ms to ensure seamless connectivity when the load-carrying vehicles are on the move.

AWK-4131A access points were installed along the tunnel walls to provide maximum wireless coverage for the AWK-1137C clients. The AWK-4131A devices are moisture-proofed, operate reliably in extreme temperatures, and come with an IP68-rated housing, making them suitable for harsh environments such as mining tunnels. In addition, the AWK-4131A APs provide 802.11n MIMO coverage on standard 2.4 GHz, 5 GHz and 5 GHz DFS channels to maximize radio performance and to reduce interference caused by the hard rock walls of the mines.

## Benefits

Turbo Roaming's millisecond-level handoff times coupled with 802.11n MIMO and 5 GHz DFS support ensure seamless live video streaming from the vehicles while they are on the move

Master/slave connection enables transparent PROFINET communication

Access points with IP68-rated weatherproof housing and -40 to 75°C operating temperatures suitable for outdoor applications

- Anti-vibration design that meets the requirements of the IEC 60068-2-6 standard for protection against interference caused by mining activities



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## Related Products



**AWK-1137C**  
Industrial IEEE 802.11a/b/g/n wireless client

<https://www.moxa.com/product/AWK-1137C.htm>



**AWK-4131A**  
Outdoor industrial IEEE 802.11a/b/g/n wireless AP

<https://www.moxa.com/product/AWK-4131A.htm>

## Learn more

**White Paper**  
Five Critical Elements of Uninterrupted Wireless Connectivity for AS/RS and AGV Systems



[www.moxa.com/wireless-AGV-wp](http://www.moxa.com/wireless-AGV-wp)

**Microsite**  
Learn more about our wireless solutions on Moxa's website.



<https://www.moxa.com/Event/industrial-wireless/aeromag/index.htm>