

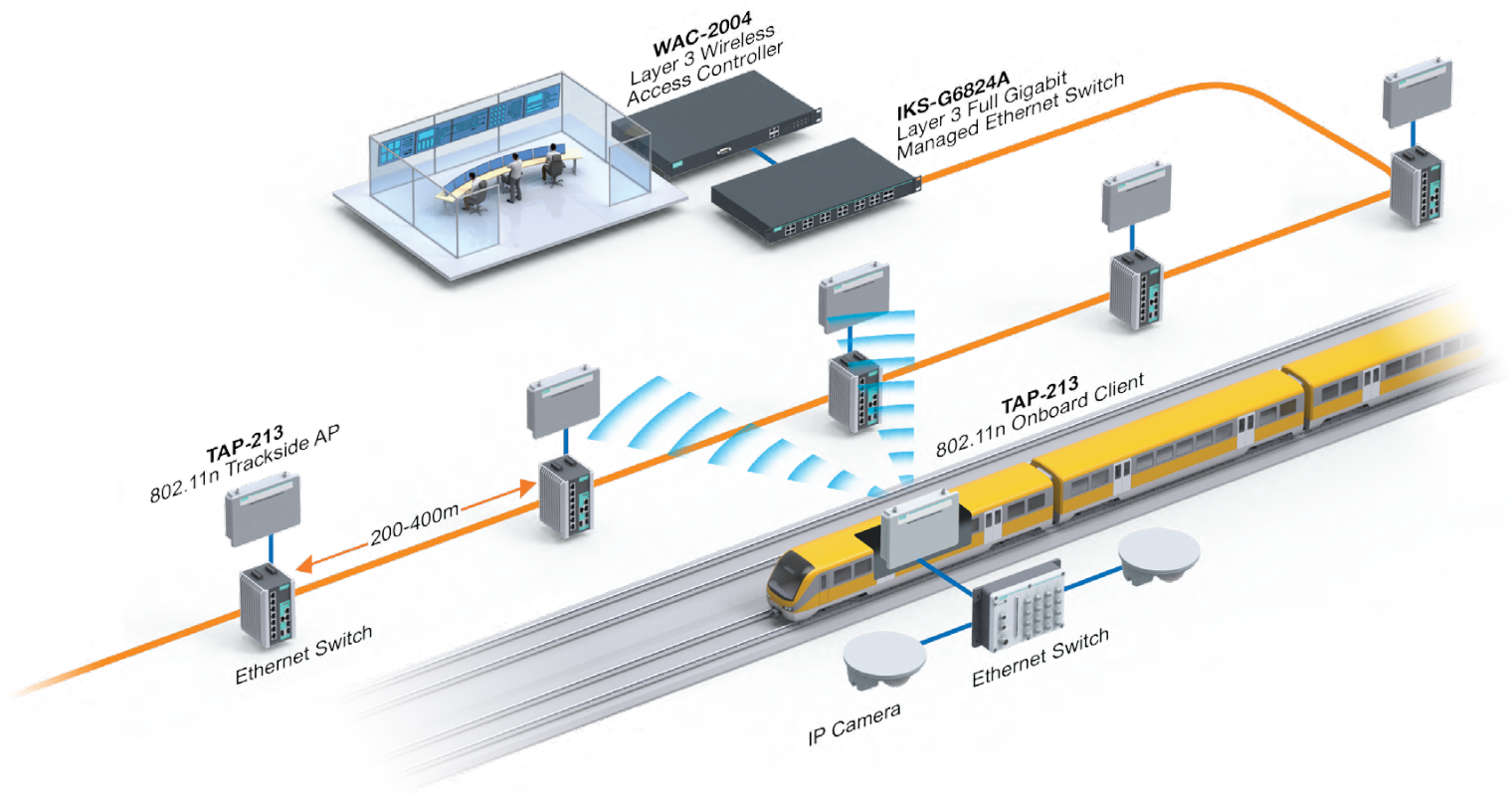
Train-to-Ground WLAN Solution

Introduction In order to facilitate train-to-ground communication, WLAN technology is frequently used as it is suitable for applications such as CCTV and CBTC systems where reliability and costs are the most important considerations. CCTV systems require high throughput and fast roaming in order to transmit video data on high-speed trains. CBTC systems require a secure network, fast roaming, and redundancy mechanisms to transmit critical data and guarantee smooth train operations. Moxa's TAP-213 onboard and trackside wireless AP/clients are specifically designed to handle multiple data transmission requirements that facilitate smooth train-to-ground WLAN communication.

CCTV Data Communication

Network Requirements

- High throughput for video connections
- Seamless roaming for continuous connections
- Rugged design to withstand harsh onboard and trackside environments



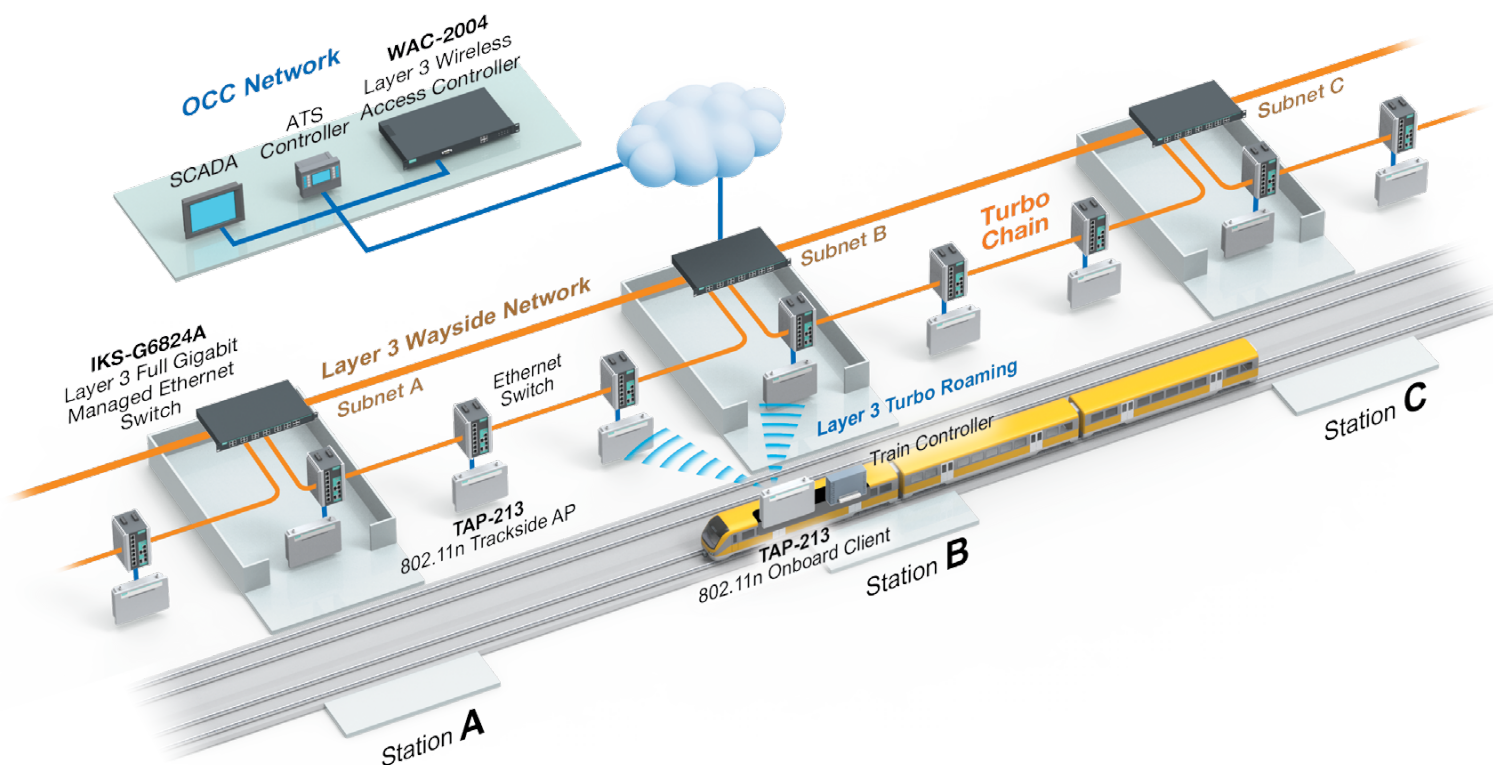
Moxa's Solution

- Use of the IEEE 802.11n standard allows data rates of up to 300 Mbps
- Controller-based Turbo Roaming technology for roaming handoff times under 50 ms
- IP68-rated products available for onboard and trackside applications
- Vibration-proof design to ensure uninterrupted connections on moving trains

CBTC Data Communication

Network Requirements

- A fast roaming mechanism to ensure seamless wireless connections
- Wireless network redundancy mechanism to provide fast network recovery
- Rugged design to withstand harsh onboard and trackside environments



Moxa's Solution

- Controller-based Turbo Roaming ensures roaming handoff times less than 50 ms
- Use of WPA, WPA2, and 802.11i security protocols ensure secure network access
- AeroLink Protection ensures 300 ms wireless network recovery times to avoid network failure
- IP68-rated products available for onboard and trackside applications
- Vibration-proof design to ensure uninterrupted connections on moving trains

Featured Products



TAP-213 Series

Onboard and trackside IEEE 802.11a/b/g/n wireless AP/client

- Can be powered by redundant dual DC power inputs or PoE
- Rugged IP68-rated housing
- -40 to 75°C wide operating temperature models (-T) available
- Compliance with the mandatory test items of the EN 50155 standard
- Compliant with the EN 50121-4 standard
- Controller-based Turbo Roaming technology that ensures roaming times less than 50 ms
- Support both layer 2 and 3 networks
- QoS (WMM) and VLAN to process network traffic efficiently
- Wireless network redundancy provided by Moxa's AeroLink Protection function

WAC-2004

Industrial wireless access controller

- 2-in-1 AP controller and mobile IP home agent
- Millisecond-level controller-based Turbo Roaming
- Compliance with the IEEE 802.11i standard
- Supports both layer 2 and 3 networks
- Use mobile IP technology to enable cross subnet controller-based roaming in layer 3 networks
- Supports controller-based roaming for network topologies that have single and multiple controllers
- Up to 450 Mbps throughput for tunneling
- Scalable tunneling capacity
- Device-level redundancy that enables the backup controller when the primary controller fails



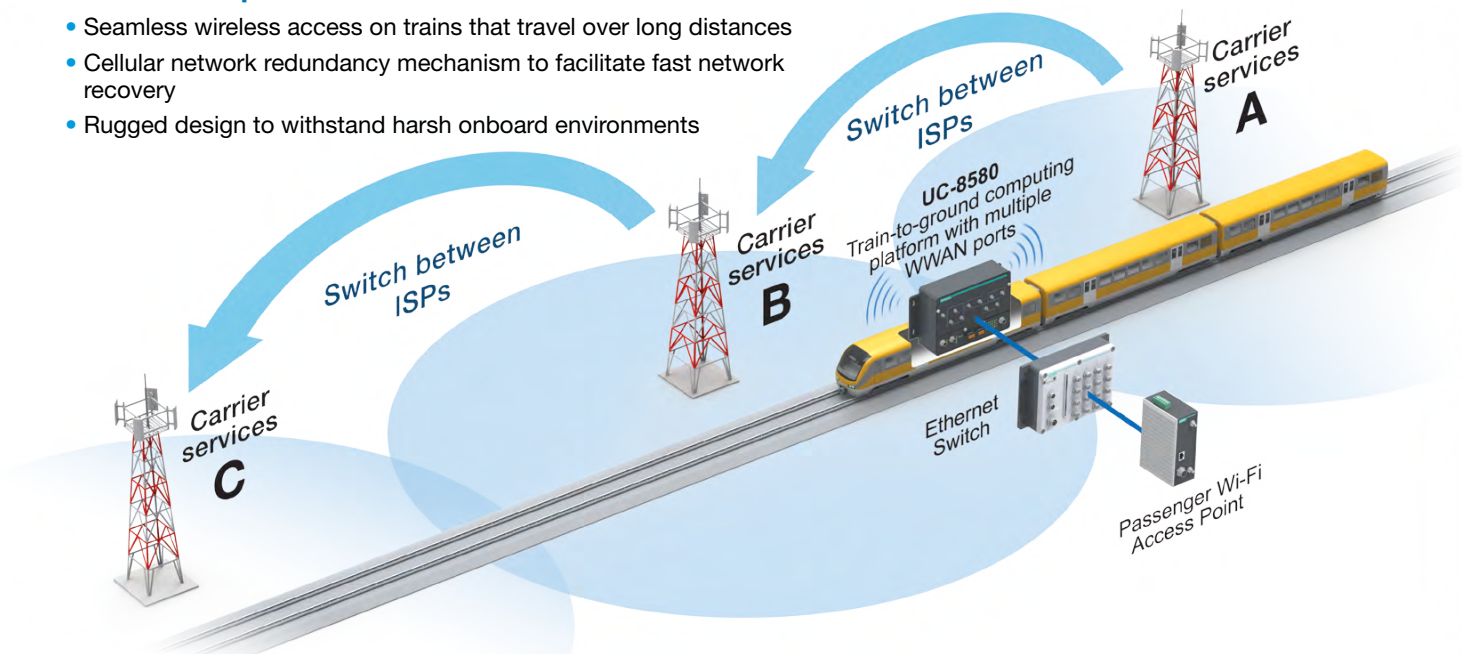
Train-to-Ground WWAN Solution

Introduction In order to enhance passengers' comfort, many train operators have introduced wireless services onboard trains. The Long-Term Evolution (LTE) standard supports more bandwidth and offers improved handover times in comparison to previous solutions. Therefore, by using WWAN, onboard infotainment including passenger Wi-Fi can help passengers have a more enjoyable journey. Moxa's UC-8580 WWAN platform supports up to 4 cellular module slots. This allows operators to deploy reliable train-to-ground WWAN communication, which enables continuous wireless access even on trains that travel over long distances.

Passenger Wi-Fi Data Communication

Network Requirements

- Seamless wireless access on trains that travel over long distances
- Cellular network redundancy mechanism to facilitate fast network recovery
- Rugged design to withstand harsh onboard environments



Moxa's Solution

- Up to 3 cellular module slots and 1 customizable slot for a cellular module to enable multiple carrier services across regions
- Dual-SIM capability to ensure that the network will not experience downtime if one SIM fails in a module
- Dynamic routing function to optimize the cellular network connection when trains travel across regions
- -40 to 70°C wide operating temperature with LTE module (Wireless modules must be purchased separately.)
- User-friendly I/O to facilitate easy maintenance

Featured Products



UC-8580 Series Train-to-ground computing platform with multiple WWAN ports

- Complies with all EN 50155 mandatory test items
- -40 to 70°C (Tx) operating temperature for use in harsh environments
- Supports up to 4 WWAN connections and 2 SIM card slots per cellular module (3 standard plus 1 customized)
- Single-panel I/O design to reduce installation space and easy maintenance
- Isolated 24 to 110 VDC power input with power-ignition function suitable for vehicle applications
- Dynamic routing function that can optimize connections between different carrier services

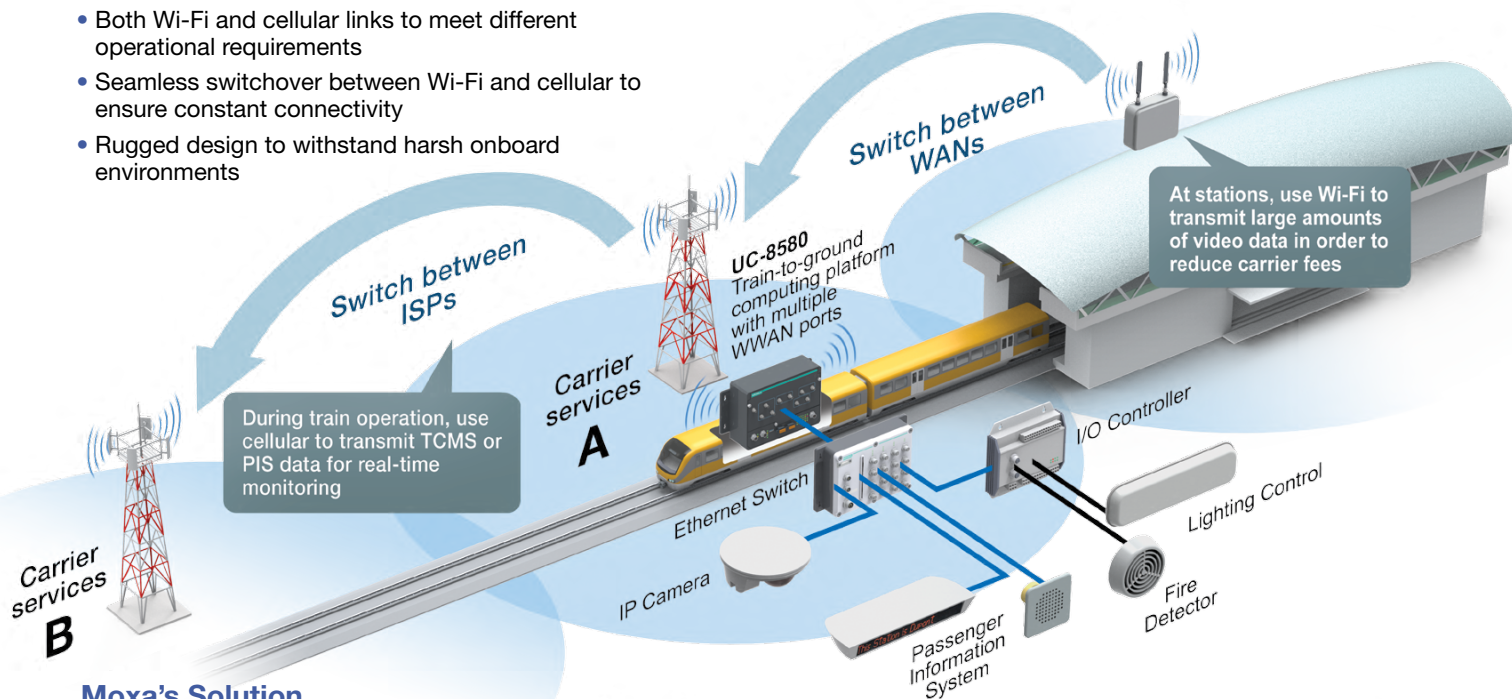
WWAN/WLAN Solutions for Train-to-Ground Communication

Introduction The main benefit of combining WLAN and WWAN into one product is that it allows users to ensure that they have the right technology available for their specific application. During train journeys, different situations arise where using either WLAN or WWAN would be more beneficial. For example, WLAN can be used when there is an existing AP e.g. when the train is at the station. However, when there is no intention of deploying an AP along the trackside it is advisable to use a cellular connection. Moxa's UC-8580 multiple WAN platform has 3 cellular module slots (WWAN) and 1 Wi-Fi module slot (WLAN), which makes it an ideal product for train-to-ground communication as it can be used in many different scenarios.

Multiple Types of Data Communication on Trains

Network Requirements

- Both Wi-Fi and cellular links to meet different operational requirements
- Seamless switchover between Wi-Fi and cellular to ensure constant connectivity
- Rugged design to withstand harsh onboard environments



Moxa's Solution

- Up to 3 cellular module slots and 1 Wi-Fi module slot to provide flexibility for different communication scenarios
- Dynamic routing function that can optimize connections based on geographic location or device connectivity status
- Dual-SIM capability to ensure that the network will not experience downtime if one SIM in a module fails
- -40 to 70°C wide operating temperature with LTE module (Wireless modules must be purchased separately.)
- User-friendly I/O to facilitate easy maintenance

Featured Products



UC-8580 Series Train-to-ground computing platform with multiple WWAN ports

- Complies with all EN 50155 mandatory test items
- -40 to 70°C (Tx) operating temperature for use in harsh environments
- Supports up to 3 WWAN connections and 2 SIM card slots per cellular module
- Supports 1 WLAN (IEEE 802.11a/b/g/n/ac) connection
- Single-panel I/O design to reduce installation space and easy maintenance
- Isolated 24 to 110 VDC power input with power-ignition function suitable for vehicle applications
- Dynamic routing function to switch between different technologies and carrier services