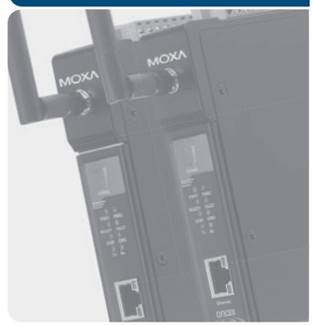


WLAN & Cellular Solutions

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WLAN & Cellular Solutions



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Industrial AP/Bridge/Client Solutions






	AWK-4222-T	AWK-4121-T	AWK-3222 AWK-3222-T	AWK-3121 AWK-3121-T
WLAN				
IEEE Standards	IEEE 802.11a/b/g/i, IEEE 802.3a/u, IEEE 802.3af			
Spread Spectrum and Modulation (typical)	• DSSS with DBPSK, DQPSK, CCK • OFDM with BPSK, QPSK, 16QAM, 64QAM 64QAM @ 54Mbps, 16QAM @ 24/36Mbps, QPSK @ 12/18Mbps CCK @ 11/5.5Mbps, DQPSK @ 2Mbps, DBSK@ 1Mbps			
Operating Channels (central frequency)	US: 2.412 to 2.462 GHz (11 channels); 5.18 to 5.24 GHz (4 channels) EU: 2.412 to 2.472 GHz (13 channels); 5.18 to 5.24 GHz (4 channels) JP: 2.412 to 2.472 GHz (13 channels, OFDM); 2.412 to 2.484 GHz (14 channels, DSSS); 5.18 to 5.24 GHz (4 channels for W52)			
Number of RF modules	2	1	2	1
Interfaces				
Number of Antenna Connectors	4	2	4	2
Antenna Connector Type	N-type (female)	N-type (female)	RP-SMA (female)	RP-SMA (female)
10/100BaseT(X) LAN Port	2	1	2	1
RS-232 Console Port	1, waterproof RJ-45	1, waterproof RJ-45	1, RJ-45	1, RJ-45
LED Indicators	PWR, FAULT, STATE, WLAN1, WLAN2, LAN1, LAN2	PWR, FAULT, STATE, WLAN, LAN	PWR1, PWR2, PoE, FAULT, STATE, WLAN1, WLAN2, 10M, 100M	PWR1, PWR2, PoE, FAULT, STATE, signal strength, CLIENT MODE, BRIDGE MODE, WLAN, 10M, 100M
Alarm Contact (Digital Output)	1	1	1	1
Digital Inputs	2	2	2	2
DI/DO Connector Type	8-pin M12 (A-coding)		10-pin terminal block	
Physical Characteristics				
Housing	Metal (IP67)	Metal (IP67)	Metal (IP30)	Metal (IP30)
Weight	1.22 kg	1.2 kg	880 g	850 g
Dimensions	224 x 147.7 x 66.5 mm		62.05 x 135 x 105 mm	53.6 x 135 x 105 mm
Installation	Wall mounting (standard), DIN-Rail mounting (optional), pole mounting (optional)	Wall mounting (standard), DIN-Rail mounting (optional), pole mounting (optional)	DIN-Rail mounting (standard), Wall mounting (optional)	DIN-Rail mounting (standard), Wall mounting (optional)
Environmental Limits				
Operating Temperature	-40 to 75°C	-40 to 75°C	0 to 60°C or -40 to 75°C	0 to 60°C or -40 to 75°C
Operating Humidity	5% to 95%	5% to 95%	5% to 95%	5% to 95%
Storage Temperature	-40 to 85°C	-40 to 85°C	-40 to 85°C	-40 to 85°C
Power Requirements				
Input Voltage	Redundant dual power inputs (12 to 48 VDC)			
Connector	5-pin M12 (A-coding)		10-pin terminal block	
IEEE 802.3af 48 VDC PoE	√	√	√	√
Reverse Polarity Protection	√	√	√	√
Regulatory Approvals				
Radio	EN300 328, EN301 893, ARIB STD-33/T66/T71 (Japan)			
EMC	EN301 489-1/-17, FCC Part 15, EN55022, EN55024	EN301 489-1/-17, FCC Part 15, EN55022, EN55024, IEC61000-6-2/-4	EN301 489-1/-17, FCC Part 15, EN55022, EN55024	EN301 489-1/-17, FCC Part 15, EN55022, EN55024, IEC61000-6-2/-4
Safety	---	EN60950-1, UL60950-1	---	EN60950-1, UL60950-1
Environment/EMC compliance	---	EN50155, EN50121-4	---	EN50155, EN50121-4
Reliability				
Warranty	5 years (see www.moxa.com/warranty)			

Wireless Serial Device Servers





	NPort® W2004	NPort® W2150 Plus NPort® W2150 Plus-T	NPort® 2250 Plus NPort® 2250 Plus-T
WLAN Interface			
IEEE 802.11b/g	√	---	---
IEEE 802.11a/g/b	---	√	√
Radio Frequency Type	DSSS/OFDM	DSSS/OFDM	DSSS/OFDM
WEP	64/128-bit data encryption		
WPA, WPA2, 802.11i	Enterprise mode and Pre-Share Key (PSK) mode		
Encryption	---	128-bit TKIP/AES-CCMP EAP-TLS, PEAP/GTC, PEAP/MD5, PEAP/MSCHAPV2, EAP-TTLS/PAP, EAP-TTLS/CHAP, EAP-TTLS/MSCHAP, EAP-TTLS/MSCHAPV2, EAP-TTLS/EAP-MSCHAPV2, EAP-TTLS/EAP-GTC, EAP-TTLS/EAP-MD5, LEAP	
Max. Transmission Rate	54 Mbps	54 Mbps	54 Mbps
Max. Transmission Distance	300 m	100 m	100 m
LAN Interface			
Ethernet Ports	1 x 10/100 Mbps (RJ45)	1 x 10/100 Mbps (RJ45)	1 x 10/100 Mbps (RJ45)
1.5 KV Magnetic Isolation Protection	√	√	√
Serial Interface			
Number of Ports	4	1	2
Serial Standards	RS-232/422/485	RS-232/422/485	RS-232/422/485
Connector	RJ45	DB9-M	DB9-M
Console Port	√	---	---
Serial Communication Parameters	Data Bits: 5, 6, 7, 8; Stop Bits: 1, 1.5, 2; Parity: None, Even, Odd, Space, Mark	Data Bits: 5, 6, 7, 8; Stop Bits: 1, 1.5, 2; Parity: None, Even, Odd, Space, Mark	Data Bits: 5, 6, 7, 8; Stop Bits: 1, 1.5, 2; Parity: None, Even, Odd, Space, Mark
Flow Control	RTS/CTS, XON/XOFF, DTR/DSR	RTS/CTS, XON/XOFF	RTS/CTS, XON/XOFF
Baudrate	50 bps to 460.8 Kbps	50 bps to 921.6 Kbps	50 bps to 921.6 Kbps
Serial Data Log	64 KB	64 KB	64 KB
Software			
Network Protocols	ICMP, IP, TCP, UDP, DHCP, Telnet, DNS, SNMP V1/V2c, HTTP, SMTP, SNTP, SSH, HTTPS		
Configuration Options	Web Console, Serial Console, Telnet Console, Windows Utility		
Management	---	SNMP MIB-II	SNMP MIB-II
Secure Configuration Options	HTTPS, SSH	HTTPS, SSH	HTTPS, SSH
Utilities	NPort® Search Utility and NPort® Windows Driver manager		
Windows Real COM Drivers	Windows 95, 98, ME, NT, 2000, XP x86/x64, 2003 x86/x64, Vista x86/x64, 2008 x86/x64, Embedded CE 5.0/6.0, XP Embedded		
Fixed TTY Drivers	SCO Unix, SCO OpenServer, UnixWare 7, UnixWare 2.1, SVR 4.2, QNX 4.25, QNX 6, Solaris 10, FreeBSD, AIX 5.x, HP-UX 11i		
Linux Real TTY Drivers	Linux 2.4.x/2.6.x		
Physical Characteristics			
Housing	Metal (IP30)	Aluminum	
Weight	1730 g	780 g	
Dimensions	45.8 x 135 x 105 mm	77 x 111 x 26 mm	
Environmental Limits			
Operating Temperature	0 to 60°C	0 to 55°C or -40 to 75°C	
Operating Humidity	5% to 95%	5% to 95%	
Storage Temperature	-20 to 85°C	-40 to 85°C	
Power Requirements			
Input Voltage	12 to 48 VDC	12 to 48 VDC	
Power Consumption	685 mA @ 12 V, 340 mA @ 24 V, 185 mA @ 48 V	560 mA @ 12 V, 294 mA @ 24 V, 162 mA @ 48 V	
Regulatory Approvals			
Safety	UL (UL60950-1), TÜV (EN60950-1)	UL (UL60950-1), TUV (EN60950-1)	
Radio	CE (ETSI EN 300 328)	CE (ETSI EN 301 893, ETSI EN 300 328), ARIB RCR STD-33, ARIB STD-66	
EMC	CE (EN55022 and EN55024 Class A, ETSI EN 301 489-17, ETSI EN 301 489-1)	CE (EN55022 and EN55024 Class A, ETSI EN 301 489-17, ETSI EN 301 489-1)	
EMI	FCC (Part 15 Subpart B Class A, Subpart C)	FCC Part 15 (Subpart B Class A, Subpart C, Subpart E), VCCI	
Reliability			
MTBF	81,501 hrs	352,547 hrs	352,034 hrs
Warranty	5 years (see www.moxa.com/warranty)		

Cellular Routers and IP Gateways



	OnCell 5004-HSDPA	OnCell 5104-HSDPA	OnCell 5004	OnCell 5104	OnCell G3110-HSDPA	OnCell G3150-HSDPA	OnCell G3110	OnCell G3150
Cellular Interface								
Standards	UMTS/HSDPA		GSM/GPRS		UMTS/HSDPA		GSM/GPRS/EDGE	
Tri-band Options	850/1900/2100 MHz		---	---	850/1900/2100 MHz		---	---
Quad-band Options	850/900/1800/1900 MHz		850/900/1800/1900 Mhz		850/900/1800/1900 MHz			
EDGE Multi-slot	Class 10	Class 10	---	---	Class 10	Class 10	Class 12	Class 12
EDGE Terminal Device	Class B	Class B	---	---	Class B	Class B	Class B	Class B
GPRS Multi-slot	Class 10	Class 10	Class 10	Class 10	Class 10	Class 10	Class 12	Class 12
GPRS Terminal Device	Class B	Class B	Class B	Class B	Class B	Class B	Class B	Class B
GPRS Coding Schemes	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4
WAN Interface								
Number of Ports	1	1	1	1	---	---	---	---
Ethernet	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	---	---	---	---
Isolation	1.5 KV Magnetic Isolation Protection				---	---	---	---
LAN Interface								
Number of Ports	4	4	4	4	1	1	1	1
Ethernet	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)	10/100M (RJ45)
Isolation	1.5 KV Magnetic Isolation Protection							
SIM Interface								
Number of SIMs	2	2	2	2	1	1	1	1
SIM Control	3 V	3 V	3 V	3 V	3 V	3 V	3 V	3 V
Serial Interface								
Number of Ports	---	---	---	---	1	1	1	1
Serial Standards	---	---	---	---	RS-232	RS-232/422/485	RS-232	RS-232/422/485
Connector	---	---	---	---	DB9-M	DB9-M and TB	DB9-M	DB9-M and TB
15 KV ESD Protection	---	---	---	---	√	√	√	√
2 KV Power EFT/Surge	---	---	---	---	√	√	√	√
Serial Parameters	---	---	---	---	Data Bits: 5, 6, 7, 8; Stop Bits: 1, 1.5, 2; Parity: None, Even, Odd, Space, Mark			
Flow Control	---	---	---	---	RTS/CTS, XON/XOFF			
Baudrate	---	---	---	---	50 bps to 921.6 Kbps			
I/O Interface								
Alarm Contacts	---	1	---	1	1	1	1	1
Digital Inputs	---	2	---	2	2	2	2	2
Software								
Network Protocols	UDP/TCP, SNTP, ICMP, DDNS, DHCP/BOOTP, PPPoE, PPP, DNS Relay, HTTPS, Telnet				ICMP, TCP/IP, UDP, DHCP, Telnet, DNS, SNMP, HTTP, SMTP, HTTPS, SNTP, ARP, SSL			
Router/Firewall	NAT, port forwarding, routing				NAT, port forwarding			
Authentication	Local user-name and password				Local user-name and password			
Security	IP filtering				Accessible IP list			
Operation Modes	---	---	---	---	Real COM, Secure Real COM, TCP Server, Secure TCP Server, TCP Client, Secure TCP Client, UDP, RFC2217, Ethernet Modem, Virtual Modem, SMS Tunnel			
Configuration and Management Options	---	---	---	---	SNMP MIB-II, SNMP Private MIB, SNMPv1/v2c/v3, DDNS, IP Report, Web/Telnet/Serial-Console/SSH			
Utilities	---	---	---	---	Provided for Windows 95/98/ME, Windows NT, Windows 2000/XP/2003/Vista/Server-2008, Windows XP/2003/Vista/Server-2008 x64 Edition			
Windows Real COM Drivers	---	---	---	---	Windows 95/98/ME, Windows NT, Windows 2000/XP/2003/Vista/Server 2008, Windows XP/2003/Vista/Server 2008 x64 Edition			
Fixed TTY Drivers	---	---	---	---	SCO Unix, SCO OpenServer 5, SCO OpenServer 6, UnixWare 7, SVR4.2, QNX 4.25, QNX 6, Solaris 10, FreeBSD 5, FreeBSD 6			
Linux Real TTY Drivers	---	---	---	---	Linux kernels 2.2.x, 2.4.x, 2.6.x			
OnCell Central	---	---	---	---	Centralized management solution for accessing private IPs from the Internet			
Physical Characteristics								
Housing	Aluminum (IP30)	Aluminum (IP30)	Aluminum (IP30)	Aluminum (IP30)	Aluminum (IP30)			
Weight	505±5 g	645±5 g	505±5 g	645±5 g	440±5 g			
Dimensions (mm)	158 x 103 x 34	160 x 103 x 50	158 x 103 x 34	160 x 103 x 50	28 x 126 x 93			
Environmental Limits								
Operating Temperature	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C
Operating Humidity	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%
Storage Temperature	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C
Power Requirements								
Input Voltage	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC
Connector	1 TB, 1 power jack	2 TBs	1 TB, 1 power jack	2 TBs	2 TBs	2 TBs	2 TBs	2 TBs
Regulatory Approvals								
Safety	UL (UL60950-1)							
RF	FCC part22H, FCC PART24F, EN301 489-1, EN301 489-7, EN301 511							
PTCRB	---	---	---	---	---	V	---	V
EMC	CE: EN55022 Class A / EN55024. FCC: FCC part 15 subpart B. Class A, EN61000-4-2 (ESD) Level 4, EN61000-4-3 (RS) Level 3, EN61000-4-4 (EFT) Level 4, EN61000-4-5 (Surge) Level 3, EN61000-4-8 Level 3, EN61000-4-12 Level 3							
Reliability								
Warranty	5 years (see www.moxa.com/warranty)							

Cellular IP and GSM/GPRS Modems

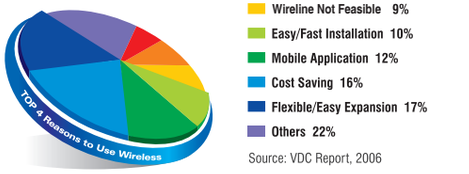


	OnCell G3111	OnCell 3151	OnCell 3211	OnCell 3251	OnCell G2100 OnCell G2100-T	OnCell G2150I
Cellular Interface						
Standards	GSM/GPRS	GSM/GPRS	GSM/GPRS	GSM/GPRS	GSM/GPRS	GSM/GPRS
Quad-band Options	850/900/1800/1900 MHz					
GPRS Multi-slot Class	Class 10	Class 10	Class 10	Class 10	Class 10	Class 10
GPRS Terminal Device Class	Class B	Class B	Class B	Class B	Class B	Class B
GPRS Coding Schemes	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4	CS1 to CS4
LAN Interface						
Number of Ports	1	1	1	1	---	---
Ethernet	10/100 Mbps (RJ45)	10/100 Mbps (RJ45)	10/100 Mbps (RJ45)	10/100 Mbps (RJ45)	---	---
1.5 KV Magnetic Isolation Protection	√	√	√	√	---	---
SIM Interface						
Number of SIMs	1	1	1	1	1	1
SIM Control	3 V	3 V	3 V	3 V	3 V	3 V
Serial Interface						
Number of Ports	1	1	2	2	1	1
Serial Standards	RS-232	RS-232/422/485	RS-232	RS-232/422/485	RS-232	RS-232/422/485
Connector	DB9-M	DB9-M	DB9-M	DB9-M	DB9-F	DB9-F and 5-pin TB
15 KV ESD Protection	√	√	√	√	√	√
2.5 KV Optical Isolation	---	---	---	---	---	√
2 KV Power EFT/Surge	√	√	√	√	---	---
Serial Communication Parameters	Data Bits: 5, 6, 7, 8; Stop Bits: 1, 1.5, 2; Parity: None, Even, Odd, Space, Mark				Data Bits: 7, 8; Stop Bits: 1, 2; Parity: None, Even, Odd, Space, Mark	
Flow Control	RTS/CTS, XON/XOFF				RTS/CTS	
Baudrate	50 bps to 921.6 Kbps				300 bps to 115.2 Kbps	
Software						
Network Protocols	ICMP, TCP/IP, UDP, DHCP, Telnet, DNS, SNMP, HTTP, HTTPS, SMTP, SNTP, ARP				---	---
Authentication	Local user-name and password				---	---
Security	Accessible IP list				---	---
Operation Modes	Real COM, TCP Server, TCP Client, UDP, SMS Tunnel, Reverse Real COM				---	---
Configuration and Management Options	SNMP MIB-II, v3, DDNS, IP Report, Web/Telnet/Serial Console, Serial Logging				---	---
Utilities	Provided for Windows 95/98/ME, Windows NT, Windows 2000/XP/2003/Vista/Server-2008, Windows XP/2003/Vista/Server-2008 x64				---	---
Windows Real COM Drivers	Windows 95/98/ME, Windows NT, Windows 2000/XP/2003/Vista/Server-2008, Windows XP/2003/Vista/Server-2008 x64				---	---
Management Software						
OnCell Central	Centralized management solution for accessing private IPs from the Internet				---	---
Physical Characteristics						
Housing	Aluminum (IP30)				ABS + PC (IP30)	
Weight	165±5 g		185±5 g		150 ± 5 g	
Dimensions	111 x 77 x 26 mm				27 x 123 x 79 mm	
Environmental Limits						
Operating Temperature	-30 to 55°C	-30 to 55°C	-30 to 55°C	-30 to 55°C	0 to 55°C or -30 to 75°C	0 to 55°C
Operating Humidity	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%
Storage Temperature	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C	-40 to 75°C
Power Requirements						
Input Voltage	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC	12 to 48 VDC
Connector	1 power jack	1 power jack	1 power jack	1 power jack	1 power jack	1 power jack
Regulatory Approvals						
Safety	UL (UL60950-1)					
RF	FCC part22H, FCC PART24F, EN301 489-1, EN301 489-7, EN301 511					
EMC	CE: EN55022 Class A / EN55024 FCC: FCC part 15 subpart B, Class A EN61000-4-2 (ESD) EN61000-4-3 (RS) EN61000-4-4 (EFT) EN61000-4-5 (Surge) EN61000-4-8 EN61000-4-12				CE (EN55022 Class A, EN55024) FCC part 15 subpart B Class A	
Reliability						
Warranty	5 years (see www.moxa.com/warranty)					

Introduction to Industrial Wireless

Why Go Wireless?

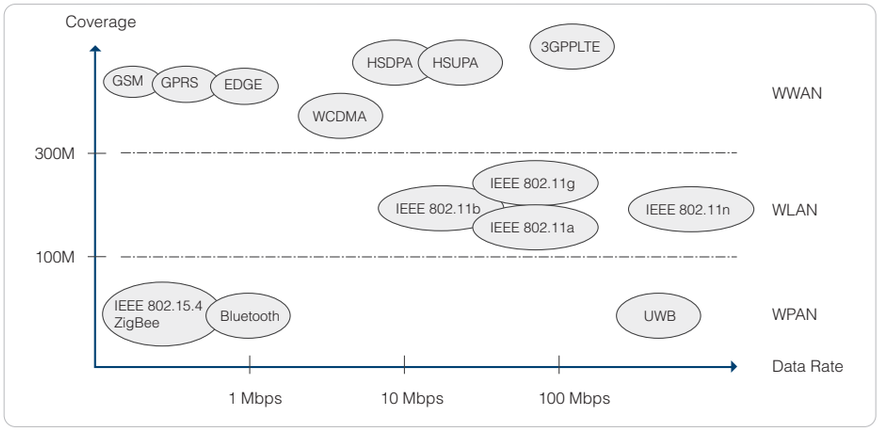
Industry has already accepted wireless networking as a mainstream solution for a number of different applications. The main consideration is the convenience of being able to connect devices without needing to rely solely on wired networks. Wireless communication provides an easier method for connecting devices, particularly those in remote or hard to wire locations. More importantly, wireless technology offers a number of key benefits, including flexible deployment, cost-effectiveness, greater versatility for expansion or migration, and wider network coverage.



Source: VDC Report, 2006

Wireless Technologies

These technologies can be broadly organized into three major categories:



WWAN

Wireless Wide Area Networks (WWANs) are digital cellular networks used for mobile phone and data service. They are operated by carriers such as Cingular Wireless, Vodafone, and Verizon Wireless, and provide connectivity over a wide geographical area. Two WWAN technologies—Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA)—dominate WWAN deployments worldwide.

WLAN

A wireless local area network (WLAN) is a LAN without cables. In contrast to WPANs, WLANs provide robust wireless network connectivity for associated clients up to 100 meters away from the access point. Today's WLANs are based on IEEE 802.11 standards and are referred to as Wi-Fi networks. The 802.11b standard, which operates in the 2.4 GHz frequency band at 11 Mbps, was the first commercially successful WLAN technology. As wireless technology matured, a higher transmission rate of 54 Mbps was achieved with 802.11g, which operates in the 2.4 Ghz band, and 802.11a, which operates in the 5 Ghz frequency band. Today, it is common for dual-band Wi-Fi access points and client network adapters to support various combinations of 802.11a, 802.11b, and 802.11g.

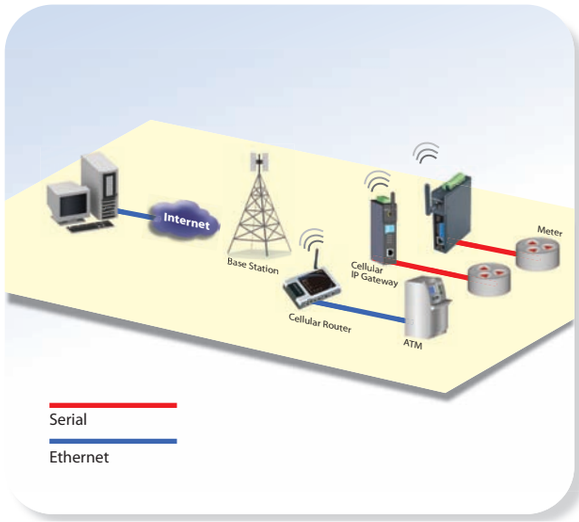
WPAN

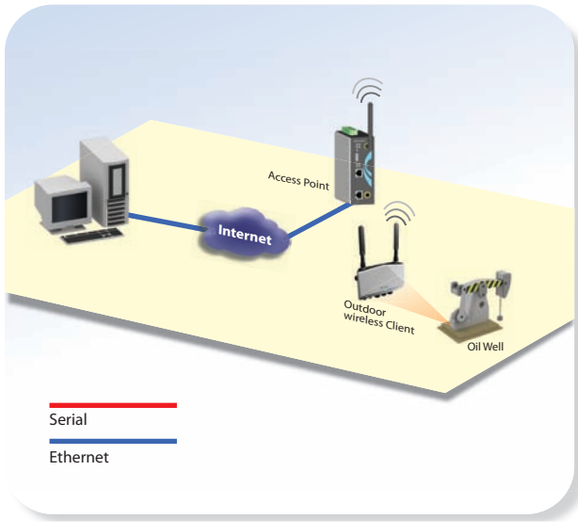
Wireless Personal Area Networks (WPANs) are very small, short-range peer-to-peer or ad hoc networks that typically extend to a maximum of 10 meters. Because of their limited range, WPANs are used mainly as cable replacement solutions for data synchronization and connectivity between devices that are close to each other. In other words, WPANs are primarily used to eliminate cables that connect devices to peripherals. Bluetooth, the prevalent WPAN technology in use today, allows devices such as phones, mice, headsets, and other peripheral devices to connect wirelessly over a range of 10 meters. Cordless mice and keyboards are typical WPAN applications.

Moxa Makes Wireless Robust, Secure, and Reliable

Moxa provides a wide selection of industrial wireless solutions that support wireless technologies including WLAN (IEEE 802.11) and GSM/GPRS/WCDMA, and serve a broad spectrum of industries around the world. Wireless network transmissions have unique security concerns, and when used in harsh industrial environments, users must also be aware of the risks posed by extreme temperatures and humidity, excessive shock and vibration, and other environmental factors. Moxa's products support a high level of security, RF redundancy, roaming, and a rugged design for both indoor and outdoor environments, and are suitable for use with a number of industrial applications, such as oil and gas, marine, and many more.







WWAN (Wireless Wide Area Network)

Benefits:

- Quad-band GSM/GPRS/EDGE cellular IP modem
- High speed HSDPA/UMTS IP modem
- AT command
- SMS tunnel
- Link PC/PLC or serial device connection, LAN and Ethernet devices to cellular networks
- Remote configuration
- TCP/IP architecture

WLAN (Wireless Local Area Network)

Benefits:

- IEEE802.11a/b/g standard
- Replaces cables
- Security
- Reliability for harsh environment
- RF and power redundancy for better performance

Core Competencies of Moxa's Industrial Wireless Products

- Wide IEEE802.11a/b/g solution with complete WEP/WPA/WPA2/IEEE802.1X security
- WLAN Turbo Roaming™ for mobile applications
- Versatile TCP/IP operating modes for use with cellular applications
- Extended temperature models available for -40 to 75°C
- IP30/IP67-rated, DIN-rail mountable, and hazardous location certifications

CASE STUDY

Communication-based Train Control System

Communication-based Train Control (CBTC) is an automated railway signaling system deployed in modern metro systems around the world. CBTC is designed to provide immediate status updates and control to avoid accidents due to exceptional conditions, such as sudden breakdowns and power losses. Due to its mobile nature, CBTC uses WLANs so that trains can update their status to the control center and receive commands from the control center in real time.

CBTC systems use access points (AP) placed about 200 meters apart along the railway. For network redundancy, APs should be installed in pairs, with all APs connected to the control center via fiber cabling. Two APs are also installed onboard each, with one in the first car and one in the last car. To ensure proper communication, the APs need to work properly at speeds as high as 80 to 100 kph. While the train is in motion, it must take less than 500 ms to transfer connection from one AP to another, and the total delay from the train to the control center must be under 2 seconds. In addition, the APs must be able to withstand excessive vibration, and EN50155 certification is a must.



Application Requirements

- Wireless communication capability at speeds up to 100 kph Low system recovery time for seamless wireless connectivity
- STP/RSTP support for resuming communication when a wired or wireless link fails
- EN50155 compliant for electronic equipment used on rolling stock

Why Moxa?

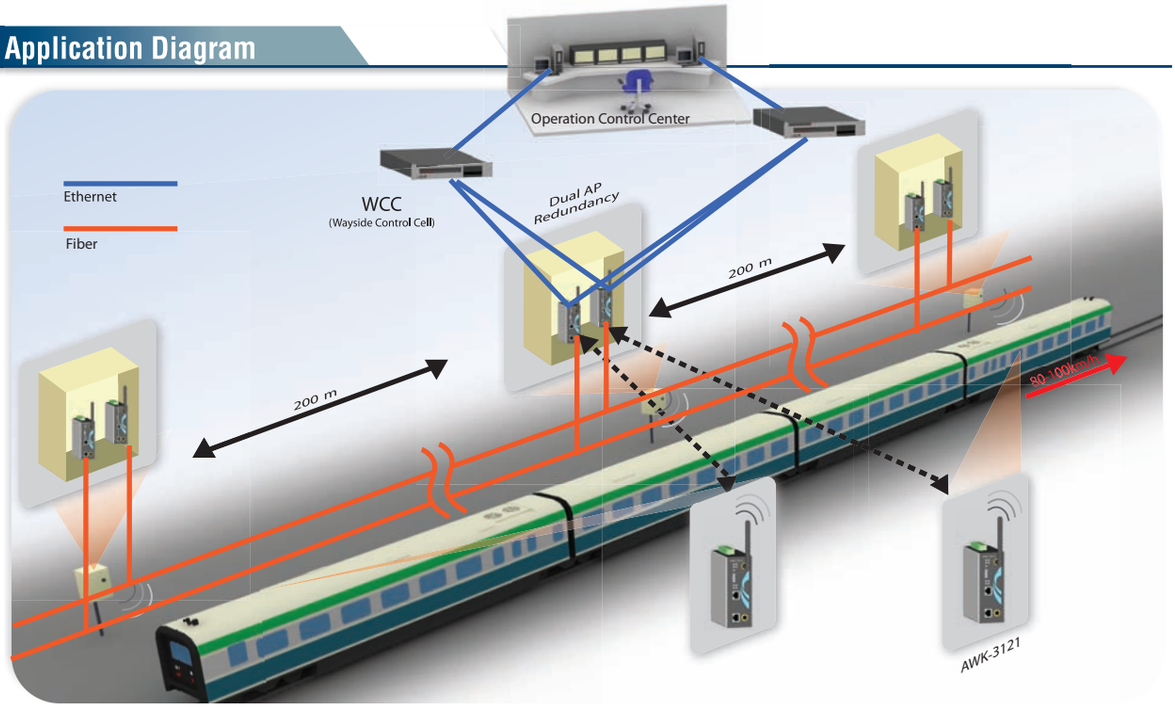
- Turbo™ roaming under 500 ms
- 100 km/h operating speed
- RSTP support

Key Products

AWK-3121 Series Industrial-strength IEEE 802.11a/b/g wireless AP/bridge/client

AWK-4121 Series IP67-rated, IEEE 802.11a/b/g outdoor wireless AP/bridge/client ,-40 to 75°C operating temperature

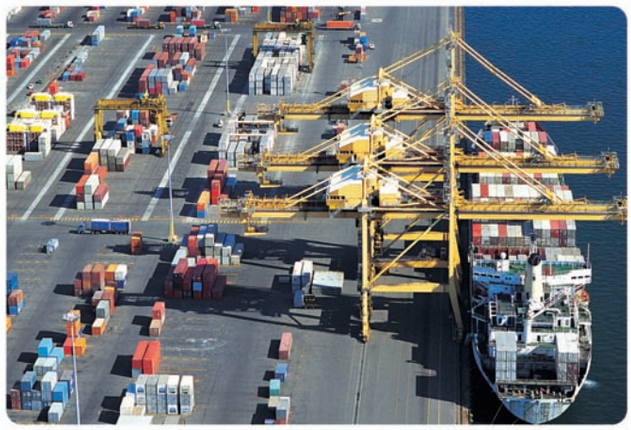
Application Diagram



CASE STUDY

Automated Heavy-duty Harbor Cranes

In port areas, containers are moved by cranes that were traditionally controlled by cables. Nowadays, these cranes are fully automated and handle bigger loads and a larger volume than before. Since transporting containers in a port is a mobile application, maintenance problems can easily arise. For this reason, wireless technology is becoming more and more popular for this kind of application. Using wireless solutions can save the cost of wiring, reduce the possibility of cable damage, and allow the implementation of remote and centralized management.



Moxa's industrial-grade AWK-3121-T and AWK-4121-T wireless access points (APs) are ideal for this type of application. An AP configured for client mode is installed on the moving arm of the crane and another AP configured for AP mode is installed on the ground, allowing the crane's PLC to control the moving arm of the crane. Both APs have a latency period under 50 ms and support a wide operating temperature range from -40 to 75°C. To increase the reliability of the wireless network, the AWK-3121-T and AWK-4121-T also support PoE (power over Ethernet) and two redundant power inputs.

Application Requirements

- Wide operating temperature
- Industrial-grade reliability and network redundancy

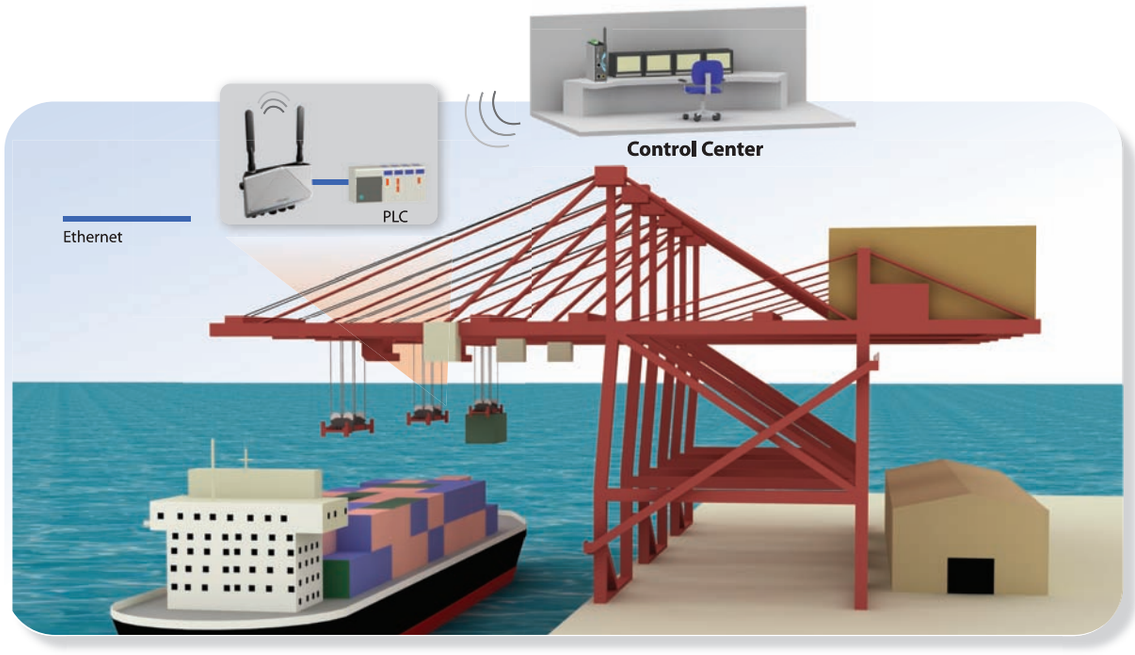
Why Moxa?

- Interference avoidance
- Latency less than 50 ms
- Wide operating temperature

Key Products

AWK-3121-T Industrial-strength IEEE 802.11a/b/g wireless AP/Bridge/Client, -40 to 75°C operating temperature
AWK-4121-T IP67-rated, IEEE 802.11a/b/g outdoor wireless AP/bridge/client, -40 to 75°C operating temperature

Application Diagram



CASE STUDY

Real-time Status Updates for MRTs

Security is extremely important for mass rapid transit systems due to the high volume of passenger traffic that is handled. In the past, the status of trains, platform gates, various alarm systems, and environmental controls were recorded manually at the stations. However, since train operators and security personnel need real-time information to handle emergency situations, wireless technology is now used to transmit information from a train to the control center while the train is approaching a station. In addition, station operators can transfer information such as the status of other trains and track conditions to arriving and departing trains.



An access point (AP) configured for Client Mode is installed in the first and last coach of each train, and another AP is installed in each station. When a train approaches a station, the AP in the first coach establishes a connection with the station and starts sending information. The length of the platform is about 100 meters, so if the AP in the first coach cannot establish a good connection, the AP in the last coach will take over. Establishing a connection as quickly as possible is important, since the train is only at the station for about 2 to 3 seconds. This means that fast roaming under 1 second is a must.

Application Requirements

- Real-time information updates and transmission between trains and stations
- Reliability and redundancy to ensure seamless network connectivity

Why Moxa?

- Seamless wireless connectivity with Turbo Roaming™ under 500 ms
- EN50155 for railway applications
- RSTP to prevent looping and guarantee high reliability

Key Products

AWK-3121 Series Industrial-strength IEEE 802.11a/b/g wireless AP/bridge/client

Application Diagram



CASE STUDY

Oil Well and Driller Management

Even though oil drilling is an old art, modern real-time networking technology is being used to make the process more energy efficient. For onshore drilling, oil wells are often spread out over a long distance, and consequently it is more efficient to use a "transmission vehicle" that transmits wireless signals. The vehicle drives from well to well to transmit data from a particular well to a central but remote control center. Using such a vehicle is much more efficient, saves on manpower costs, and helps avoid operating errors.

One AP is installed on the oil well to connect to a PLC that monitors the temperature, oil pressure, and other readings. Another AP on the transmission vehicle is set up for client mode. When the transmission vehicle approaches the oil well, the controller on the detecting car establishes a connection with the PLC and downloads the data. To make sure the transmission vehicle can receive data while approaching the oil well, a roaming function is required. Even though the AP is not placed directly in a highly hazardous area, UL Class 1 Division 2 or ATEX Class I Zone II certifications are needed to ensure a basic level of safety. The ability to be able to withstand wide temperatures, especially high temperatures, is also important for this kind of application.



Application Requirements

- UL Class 1 Division 2 and ATEX Class I Zone II certifications
- Fast roaming for transmission vehicles travelling between oil wells

Why Moxa?

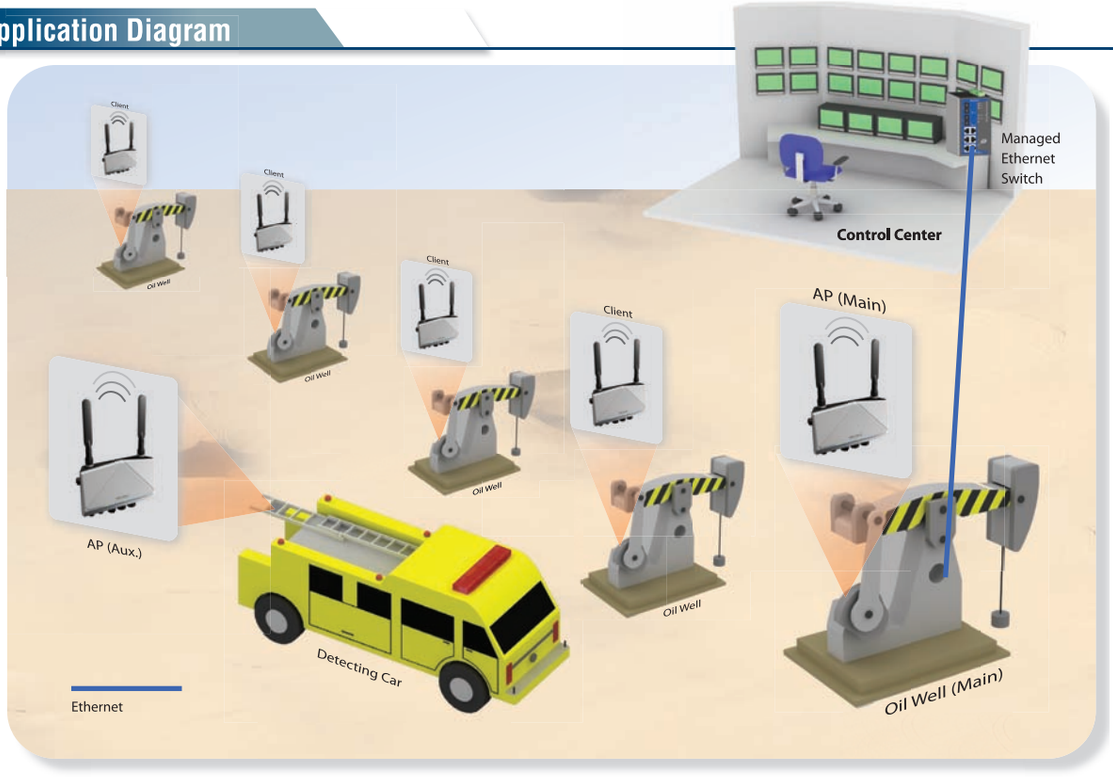
- Standardwireless solutions are more cost-effective than proprietary wireless solutions
- Turbo Roaming™ between oil wells is under 1 second
- Rugged, outdoor design for critical environments
- UL Class 1 Division 2 and ATEX Class I Zone II certifications
- Wide operating temperature range of -40 to 75˚C

Key Products

AWK-4121-T IP67-rated, IEEE 802.11a/b/g outdoor wireless AP/bridge/client, -40 to 75°C

AWK-3121-T Industrial-strength IEEE 802.11a/b/g wireless AP/bridge/client, -40 to 75°C

Application Diagram



CASE STUDY

Feeder Terminal Units for Power Distribution

Feeder terminal units (FTUs) play a crucial role in delivering electricity to consumers, and since power plants are often located far from the population centers they serve, electricity must be transmitted across long distances at a high voltage. Power lines deliver electricity from the plant to power substations where it is converted to a lower voltage before it is distributed to the local community by FTUs. Due to safety concerns, FTUs are usually connected in a ring topology within the communities they serve. This design prevents the entire power grid from going down if one of the FTUs fails. Industrial wireless solutions are well suited for FTU applications given their distributed placement and the difficulties associated with building and maintaining a wired infrastructure.

By connecting each FTU to a cellular IP modem such as the OnCell 3000 series, system administrators can receive notifications from the FTUs whenever one of the FTUs goes down. When this happens, the neighboring FTUs will shut off that segment of the ring to prevent the entire power grid from crashing. However, since electricity may be cut off to the rest of the ring, the cellular modem for the downed FTU will notify the RFTU (remote feeder terminal unit) via the control room. The control room then sends a command over the cellular network to switch on the adjacent FTUs to resume power flow in the ring. This design shortens power grid recovery time and simultaneously handles centralized data monitoring. In addition, since the OnCell 3100 series supports Real COM mode, the RFTU does not need to implement special software or use AT commands to implement a TCP/IP connection, saving R&D and maintenance effort.



Application Requirements

- Shortened power grid recovery time
- Wireless connectivity for legacy FTUs
- Simple system structure and easy maintenance

Why Moxa?

- No need to implement TCP/IP protocols and programs on the FTU
- TCP server/client modes
- Two destination IPs
- “Heartbeat” feature indicates when the modem is on
- 2 KV surge protection

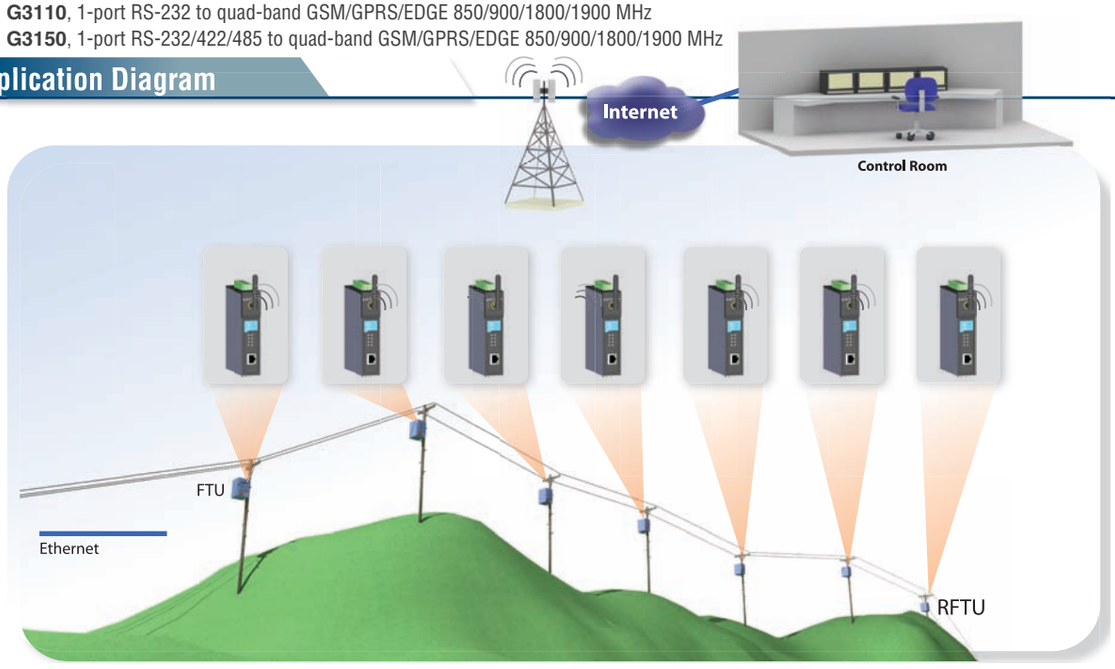
Key Products

OnCell G3100 series of industrial cellular IP gateways

OnCell G3110, 1-port RS-232 to quad-band GSM/GPRS/EDGE 850/900/1800/1900 MHz

OnCell G3150, 1-port RS-232/422/485 to quad-band GSM/GPRS/EDGE 850/900/1800/1900 MHz

Application Diagram



Getting un-Wired with IEEE 802.11

Introduction

Are you ready for the convenience that comes from sending your Ethernet packets over the air instead of through a wire? Wireless is not for everyone, but if your application uses mobile equipment that is controlled over a TCP/IP network, or the cost of installing wire conduits at your work site is prohibitive, then consider setting up a wireless local area network (WLAN). The IEEE 802.11 standard specifies a way to use radio frequency (RF) technology to send Ethernet packets over the air. Applications that include TCP/IP will run on 802.11-compliant WLANs the same as they do over Ethernet. By common agreement between regulatory agencies around the world (FCC, ETSI, etc.), a WLAN transmits over unlicensed spectrums, with only minor variations from country to country.

802.11 Specifications

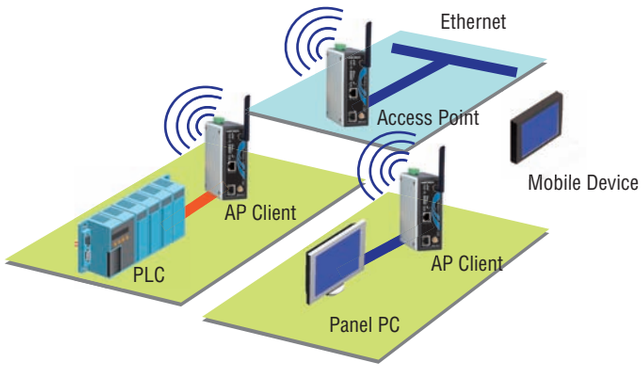
IEEE 802.11, commonly referred to as Wi-Fi, is widely used for wireless communications. Wireless connectivity eliminates the need to install either fiber or Ethernet cable in hard-to-wire locations. IEEE 802.11 is not an alternative to broadband, but it is a fast and efficient way to distribute broadband transmissions, even in critical environments. Choosing the right WLAN technology is an important factor in determining the performance of your wireless network and overall return on investment.

Standard	IEEE 802.11b	IEEE 802.11a	IEEE 802.11g	IEEE 802.11n
Year Approved	1999	1999	2003	Est. 2009[a]
Compatibility	IEEE 802.11b compliant	IEEE 802.11a compliant	IEEE 802.11b/g compliant	IEEE 802.11a/b/g compliant
Frequency Band	2.4 GHz	5 GHz	2.4 GHz	2.4/5 GHz
Channel Bandwidth	20 MHz	20 MHz	20 MHz	20 or 40 MHz
Number of Spatial Streams	1	1	1	1 to 4
Max. Data Rates	11 Mbps	54 Mbps	54 Mbps	600 Mbps
Data Rate Configurations	4	8	12[b]	576
Spread Spectrum	DSSS	OFDM	OFDM, DSSS	OFDM
Typical Indoor Range[c]	100 to 150 ft	30 to 50 ft	100 to 150 ft	150 to 200 ft
Typical outdoor Range[c]	200 to 300 ft	50 to 100 ft	200 to 300 ft	450 to 600 ft

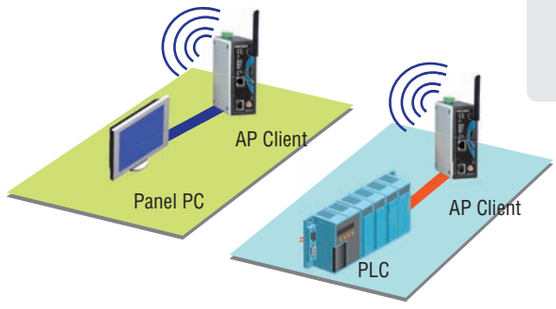
a. IEEE 802.11n is expected to be finalized in 2009, but the market has already started migrating to 802.11n networks based on Draft 2 of the 802.11n proposal.
b. IEEE 802.11b includes backwards compatibility.
c. This is a general rule of thumb that can be applied when planning a wireless network.

Operation Modes

The most common operation modes for wireless networks are AP-client mode and bridge mode. In AP-client mode, a wireless AP is required to set up a basic infrastructure service set (BSS) for wireless connectivity. The AP can be used by itself to set up a WLAN, or can be used to connect the WLAN to a wired network. In either case, all wireless communication goes through the AP. Bridge mode provides an easy way to extend a network with peer-to-peer transmission to send information between two individual APs connecting wired networks or Ethernet-enabled devices at their LAN ports.



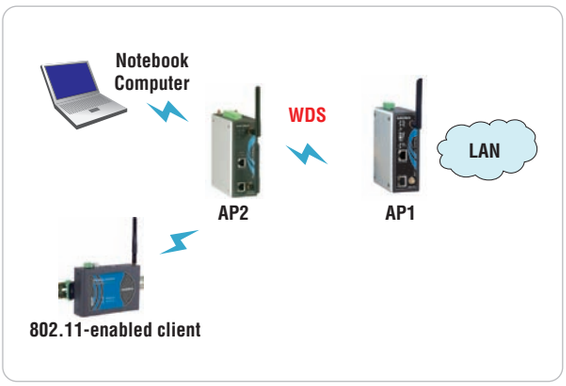
AP-Client Operation

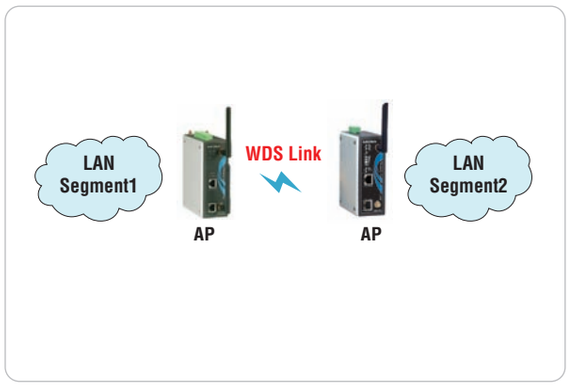


Bridge Operation

WDS

The Wireless Distribution System (WDS) provides an easy way for APs to communicate wirelessly with each other. As shown in the figure on the left below, one AP acts as a wireless access point and forwards packets to the other AP through the WDS before the packets are sent to the Ethernet LAN. In addition, two or more LAN segments can be connected wirelessly. As illustrated in the figure on the right below, a pair of wireless LAN-to-LAN bridges is used to connect two LAN segments. Since the AP is WDS-enabled, it can operate in bridge mode.

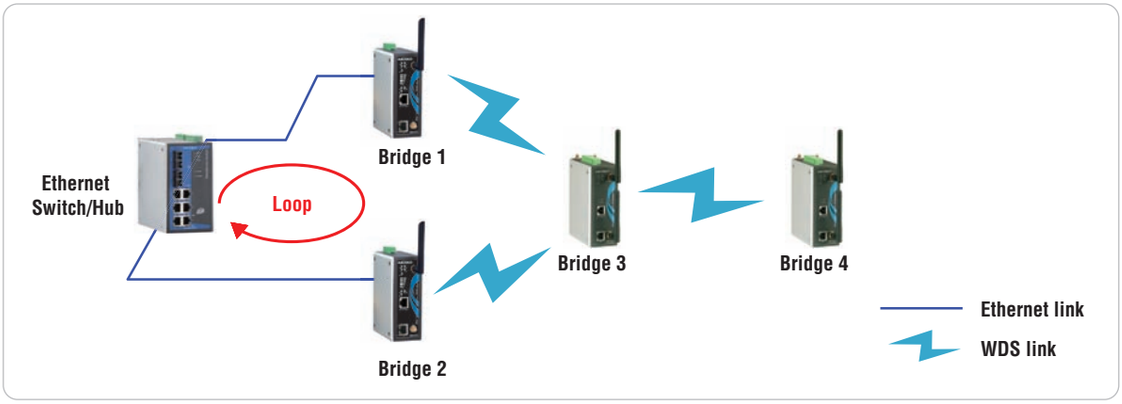




STP/RSTP

Spanning Tree Protocol (STP) was designed to help reduce link failures in a network and provide protection from loops. STP can effectively increase system reliability to allow your network to run non-stop. Networks that have a complicated architecture are prone to broadcast storms caused by unintended loops in the network. STP is part of the IEEE 802.1D standard (1998 Edition) bridge specification.

Rapid Spanning Tree Protocol (RSTP) implements the Spanning Tree algorithm and protocol defined by the IEEE 802.1w-2001 standard. RSTP is not only backwards compatible with STP, but is able to determine the topology of a bridged network much more quickly than STP.



Wireless Security

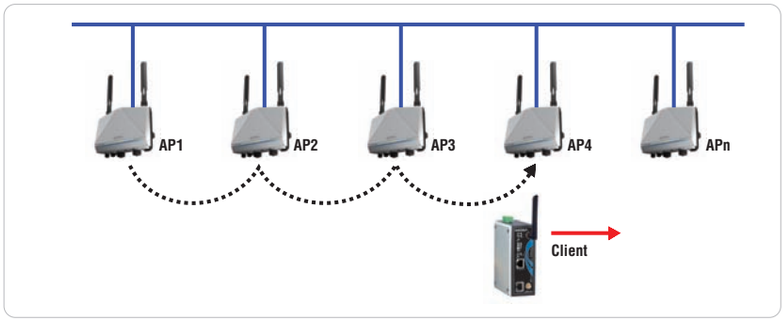
Wireless networks use radio waves, which means that your data is prone to interception by other parties. A proper protection mechanism for radio transmissions on any network is always a concern for protocol designers. The right balance between security, transparency, and cost effectiveness is important when determining the type of security to use for your WLAN. You should take into account your target environment, the security levels that your WLAN can support, and the effect that stronger security methods could have on performance. The following table summarizes implementation considerations and client requirements when using WLAN security methods.

Method	Client Support	Considerations
WEP	Built-in support on all 802.11a, basic 802.11b, and 802.11g devices	-Provides basic security -Requires manual key management
WPA	Requires WPA-enabled system and network card driver	-Provides dynamically generated keys that are periodically refreshed -Provides similar shared key user authentication -Provides robust security for small networks
WPA2	Requires WPA-enabled system and network card driver	-Provides robust security for small networks -Wireless stations may require hardware to upgrade to WAP2
802.1X	Requires WPA-enabled system and network card driver	-Provides dynamically generated keys that are backwards compatible with the original WPA

Industrial-grade Wireless LANs

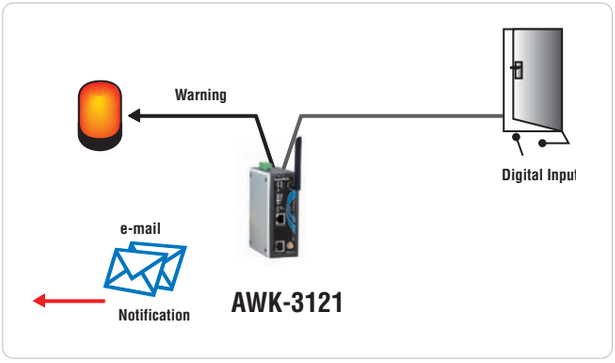
Roaming for Non-stop Connection

IEEE 802.11 technology gives networks an effective range of only a few hundred meters, which means that maintaining communication between devices that are on the move requires handing access off from one access point to another. Without an advanced roaming technology, this could result in frequent handoffs and poor performance, since reconnecting must be done every five to ten seconds in a highly mobile environment. “Roaming” is a general term in wireless communications that refers to extending connectivity service to different locations. Moxa’s Turbo Roaming™ technology provides seamless wireless connections, and enables fast Basic Service Set (BSS) transitions between APs.



Long-distance Communication

Generally speaking, IEEE 802.11 standards are not designed for outdoor use, and long-distance communication is not fully considered. When the distance between two wireless devices is increased, packets need to travel a longer distance. Communication over such a long distance can become instable, which leads to a drop in network performance. The AWK’s support for long distance communication makes it easy to configure a long-distance solution. Based on the specified distance, a proprietary algorithm developed by Moxa determines which parameters should be used to optimize performance. Practical uses of the algorithm include the deployment of long-range point-to-point and point-to-multipoint wireless networks.



DI/DO

Moxa AWK series of APs are often located at remote parts of an industrial wireless LAN, making it difficult for system administrators to know the status of such devices or monitor the surrounding environment. The traditional way of determining device status is to poll devices periodically, but this is not “real-time” enough for many modern applications, and it also wastes precious computing resources. Besides, an auxiliary sub-system may be needed to support environment monitoring, which would add an additional cost.

A more modern solution to this problem is to use industrial-grade APs that provide system maintainers with real-time alarm messages almost instantaneously when exceptions occur. In other words, warning messages are triggered actively when the events, such as link up/down and power on/off, occur. Integrated with other important sensors via digital inputs (DI), the AWK can also provide an automatic alarm mechanism. This is done by redirecting warning messages to an IP network by email or log record.

AWK series products are equipped with relay outputs (digital output, DO) that can be configured to indicate the importance of events when notifying or warning engineers in the field. In response, engineers can respond to higher priority messages quickly and with the appropriate emergency maintenance procedures.

Certified to Meet Industrial Reliability Standards

Industrial environments often involve unknown, hazardous factors that can influence the operation of Ethernet devices. In fact, some factors could cause serious disasters or the loss of life and property. Moxa’s industrial products have received UL/cUL Class 1 Division 2 and ATEX C1Z2 certifications, which were developed to indicate which industrial control and information technology equipment is suitable for hazardous locations such as maritime environments, mines, oil refineries, and other industrial settings. In addition, the environmental compliancy with EN50155 and EN50121-3-2 standards is essential for testing and determining which devices can be used safely and reliably in railway-related and on-train applications.

AWK-4222 Series

Preliminary

Industrial IEEE 802.11a/b/g outdoor Dual-RF AP/Bridge/Client



- IEEE 802.11a/b/g compliant
- Redundant power inputs and PoE
- Higher security with WEP/WPA/WPA2/802.11X and powerful filters
- Turbo Roaming™ for seamless wireless connections
- Dual-RF design for redundant wireless communication
- Wide operating temperature range and IP67-rated metal housing for hazardous environments

The certification logos shown here apply to some or all of the products in this section. For details, see "Regulatory Approvals" under "Specifications" below.

Introduction

The AWK-4222 outdoor dual-RF wireless AP/Bridge/Client provides a flexible solution for industrial applications in a critical environment. The AWK-4222 is rated to operate at temperatures ranging from -40 to 75°C, and its dust-tight and weatherproof design is IP67-rated, allowing you to extend existing wired networks to outdoor locations. With two independent RF modules, the AWK-4222 supports a greater variety of wireless configurations and applications. It can also increase the reliability of entire wireless network by enabling redundant wireless connections. The AWK-4222 also has two redundant DC power inputs to increase the reliability of the power supply, and can be powered via PoE.

Redundancy to Increase System Reliability

- PoE and dual DC power inputs
- Redundant dual-RF design for rapid fail-over
- Immunity against disconnection caused by radio interference
- Loading balance of wireless communication

Ruggedized Design for Critical Environment

- IP67-rate metal housing
- Waterproof and dust-tight RJ45 connections
- M12 connectors protect againt shock and vibration
- Hardened mounting kit for flexible installation outdoors

Specifications

WLAN Interface

Standards:
IEEE 802.11a/g/b for Wireless LAN
IEEE 802.11i for Wireless Security
IEEE 802.3u for 10/100BaseT(X)
IEEE 802.3af for Power-over-Ethernet
IEEE 802.1D for Spanning Tree Protocol
IEEE 802.1w for Rapid STP

Spread Spectrum and Modulation (typical):
• DSSS with DBPSK, DQPSK, CCK
• OFDM with BPSK, QPSK, 16QAM, 64QAM
64QAM @ 54 Mbps, 16QAM @ 24/36 Mbps, QPSK @ 12/18 Mbps, CCK @ 11/5.5 Mbps, DQPSK @ 2 Mbps, DBSK@ 1 Mbps

Operating Channels (central frequency):
US:
2.412 to 2.462 GHz (11 channels)
5.18 to 5.24 GHz (4 channels)
EU:
2.412 to 2.472 GHz (13 channels)
5.18 to 5.24 GHz (4 channels)
JP:
2.412 to 2.472 GHz (13 channels, OFDM)
2.412 to 2.484 GHz (14 channels, DSSS)
5.18 to 5.24 GHz (4 channels for W52)

Security:
• SSID broadcast enable/disable
• Firewall for MAC/IP/Protocol/Port-base filtering
• 64-bit and 128-bit WEP encryption, WPA/WPA2 Personal and Enterprise (IEEE 802.1X/RADIUS, TKIP and AES)

Transmission Rates:
802.11b: 1, 2, 5.5, 11 Mbps
802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps

TX Transmit Power:
802.11b:
Typ. 18±1.5 dBm @ 1 to 11 Mbps
802.11g:
Typ. 18±1.5 dBm @ 6 to 24 Mbps, Typ. 16±1.5 dBm @ 36 to 48 Mbps, Typ. 15±1.5 dBm @ 54 Mbps
802.11a:
Typ. 16±1.5 dBm @ 6 to 24 Mbps, Typ. 14±1.5 dBm @ 36 to 48 Mbps, Typ. 13±1.5 dBm @ 54 Mbps

RX Sensitivity:
802.11b:
-92 dBm @ 1 Mbps, -90 dBm @ 2 Mbps, -88 dBm @ 5.5 Mbps, -84 dBm @ 11 Mbps
802.11g:
-87 dBm @ 6 Mbps, -86 dBm @ 9 Mbps, -85 dBm @ 12 Mbps, -82 dBm @ 18 Mbps, -80 dBm @ 24 Mbps, -76 dBm @ 36 Mbps, -72 dBm @ 48 Mbps, -70 dBm @ 54 Mbps
802.11a:
-87 dBm @ 6 Mbps, -86 dBm @ 9 Mbps, -85 dBm @ 12 Mbps, -82 dBm @ 18 Mbps, -80 dBm @ 24 Mbps, -76 dBm @ 36 Mbps, -72 dBm @ 48 Mbps, -70 dBm @ 54 Mbps

Protocol Support

General Protocols: Proxy ARP, DNS, HTTP, HTTPS, IP, ICMP, SNTP, TCP, UDP, RADIUS, SNMP, RTP

AP-only Protocols: ARP, BOOTP, DHCP, dynamic VLAN-Tags for 802.1X-Clients, STP/RSTP (IEEE 802.1D/w)