

SIEMENS



Airlink[®] ACSES

PTC Data Radio

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The Airlink ACSES is a state-of-the-art, software-defined radio (SDR) designed for onboard and wayside communications for the Advanced Civil Speed Enforcement System (ACSES), the Positive Train Control (PTC) system used by Amtrak and other commuter railroads in the Northeast Corridor. Not only is Airlink ACSES a functionally equivalent replacement for existing PTC data radios used in ACSES, but it also complies with IEEE 802.16-2017, providing secure, wide-area, broadband IP connectivity for mission-critical rail operations.



Airlink ACSES supports the ACSES over-the-air interface and Simple Timeslot/Frequency Power (STFP) protocols, ensuring full compatibility with existing PTC data radios. It offers superior RF performance and filtering, improved security, higher internal transmit power/duty cycle, and an edge computing platform capable of running an embedded Docker container for third-party applications, such as a communications manager.

Airlink ACSES eliminates the need for external filters with its extensive internal receive and transmit filtering. It achieves high Adjacent Channel Rejection (ACR) and blocker performance through advanced filtering and signal processing, including SAW/Crystal filters in the intermediate frequency stage, a 16-bit ADC for signal quality amid strong interference, and a precise digital filter to eliminate out-of-band interference.

Airlink ACSES can operate in either "legacy" ACSES mode or IEEE 802.16-2017 mode. IEEE 802.16-2017 is an open over-the-air interface standard for deploying general-purpose wireless IP networks using narrowband channels and is the only standard developed specifically for mission-critical industries.

In IEEE 802.16-2017 mode, Airlink ACSES supports modern modulation schemes such as QPSK, 16QAM, and 64QAM, along with multiple Forward Error Correction (FEC) rates. The Adaptive Modulation and Coding Scheme (MCS) automatically selects the optimal modulation and coding based on the Carrier to Interference and Noise Ratio (CINR), independently for each remote radio and for both downlink and uplink directions. With an internal Power Amplifier (PA) supporting a 50% duty cycle at a maximum transmit power of 25 Watts, Airlink ACSES can run 64QAM modulation at full power. The raw data rate reaches up to 6 bits/sec/Hz. Additionally, in IEEE 802.16-2017 mode, Airlink ACSES can use any continuous channel bandwidth up to 50 kHz available in the 220 MHz band.

The Airlink ACSES radio platform includes robust security features such as a Trusted Platform Module (TPM), hardware-based secure boot at the root of the "chain of trust," and a NIST-certified hardware random number generator using TPM. It ensures trusted updates with authenticated and validated upgrades and configuration changes, role-based authentication and access control, and security events monitoring that is audit-ready. The platform also supports secured SNMPv3 remote management and SSHv2 local management. When operating in IEEE 802.16-2017 mode, Airlink ACSES offers additional security features, including AES-256 traffic encryption and EAP-TLS based authentication using X.509 certificates and RSA-4096 public key encryption.

Operating in a point-to-multipoint IEEE 802.16-2017 network, Airlink ACSES functions as both a base station radio and a remote radio. In both roles, it acts as an Ethernet learning bridge, forwarding Ethernet frames end-to-end. As a base station, Airlink ACSES manages QoS profiles for all remote radios within its serving area, including parameters such as scheduler type, priority, and Minimum Sustained Rate (MSR).

RADIO SPECIFICATIONS

	Frequency Range	216 MHz to 222 MHz
	TX Power	33 to 44 dBm (2 to 25W) @ antenna port
	Duplex Method	HD-FDD, TDD
ACSES Mode	Channel sizes	12.5 kHz
	Throughput (raw data)	9.6 kbps
	Topology	Point to multipoint
	Rx Sensitivity	See "RF PERFORMANCE – ACSES MODE" below
	Waveform	Single carrier
	Air interface protocol	ACSES
	Modulation	GMSK
	Forward Error Correction (FEC)	Reed Solomon (147,131).
802.16 Mode	Channel sizes	12.5 KHz, 25 KHz, 50 KHz
	Throughput	Up to 150 kbps
	Topology	Point to MultiPoint, Direct Peer-to-Peer (DPP only in 802.16t)
	RX sensitivity	As low as – 120 dBm
	Waveform	Multi-carrier
	Air interface protocol	802.16-2017 (upgradeable to 802.16t)
	Modulation	QPSK, 16-QAM, 64-QAM
	Forward Error Correction (FEC)	Convolutional Coding (CC) with rates 1/2, 2/3, 3/4
	Adaptive modulation	Dynamically Adjusted
	QOS	Best effort, Real time polling service, Unsolicited Grant Service

RF PERFORMANCE

ACSES Mode	RX Co-Channel	-15 dBc
	RX Adjacent Channel	1st - 60 dB 2nd - 63 dB 3rd to 5th - 66 dB
	Intermodulation Rejection	500 kHz / 1 MHz 60 dB
	Blocking Rejection	80 dB for signals $\geq \pm 1$ MHz out of band
	Sensitivity (1% packet error rate with FEC enabled)	Static: -105 dBm Dynamic: -99 dBm when considering vehicle speeds up to 165 MPH

PHYSICAL CHARACTERISTICS

	Power Input	11-36 VDC
	Power Consumption	Up to 50W while transmitting at 25 Watts @ 50% duty cycle
	Humidity	95% at 40°C non-condensing
	Dimensions	8.05" x 5.32" x 2.25" (204mm x 135mm x 57mm)
	Enclosure Protection Rating	IP 50 Standard
	Operating Temperature	-40°C to +70°C

CONNECTORS / INTERFACES

	DC Input	M12 L-coded connector with chassis ground
	GPS Antenna	SMA Female - Active 3.3 VDC
	External GPS	M12 A-coded connector NMEA over RS-232 and 1 PPS over 2-wire 0-5 VDC interface
	Ethernet (operations)	M12 D-coded connector
	Maintenance	RJ45 incorporating Ethernet and Console interfaces
	Antenna Port	Type N Female Connector, 50 Ω
	LEDs	Power, Radio Status, Eth 1 Status/Activity Radio TX, Radio RX, 2 x spare (API configurable)

SECURITY FEATURES

	Trusted Platform Module (TPM)
	Hardware Based Secure Boot at the Root of the "Chain of Trust"
	NIST Certified Hardware Random Number Generator using TPM
	Trusted Updates: Authenticated and Validated Upgrades and Configuration Changes
	Role-based authentication and access control
	Security Events Monitoring, Audit Ready
	Secured SNMPv3 Remote Management
	SSHv2 Local Management
802.16-2017 Mode	AES-256 Traffic Encryption
	EAP-TLS Based Authentication with X.509 Certificate and RSA-4096 Public Key Encryption

COMPLIANCE

	AAR S-9401 / EN-50155
	FCC Part 80, Part 90, and Part 95C
	AREMA 11.5.1

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