AIRLINK ACSES
POSITIVE TRAIN CONTROL RADIO

ONDAS
N E T W O R K S

The **Airlink® ACSES** Software Definable Radio **(SDR)** is designed to serve as a fully interoperable, drop-in replacement to the existing ACSES PTC data radio used in onboard and wayside installations. The Airlink® ACSES supports the legacy ACSES air interface protocol and STFP (Simple Timeslot / Frequency Power Protocol). As such, it can be integrated seamlessly into any ACSES system. The Airlink® ACSES may be configured to operate in legacy ACSES mode or in state-of-the-art IEEE 802.16-2017 mode. IEEE 802.16-2017 is an open standard for deploying general purpose IP networks in narrowband channels.

When operating in legacy ACSES mode, Airlink® ACSES has superior performance relative to the existing ACSES PTC data radio including better RF performance and filtering, improved security, higher internal transmit power/duty cycle, and support of Docker containers to run an internal communications manager.

Fully interoperable, drop-in replacement for ACSES PTC data radios

When operating in IEEE 802.16-2017 mode, Airlink® ACSES supports a wide range of state-of-the-art wireless communication features including support of QPSK, 16QAM and 64 QAM modulations and multiple FEC rates. Adaptive Modulation and Coding Scheme (MCS) is used to automatically select the highest possible modulation and coding scheme based on the CINR. The selection is done for each remote radio independent of the other remotes and for downlink and uplink directions independent of each other. The raw data rate ranges up to 6 bits/sec/Hz. Moreover, when operating in IEEE 802.16-2017 mode, Airlink® ACSES can operate in any continuous channel bandwidth available in the 220 MHz band up to 50 kHz.

Due to its extensive internal receive and transmit filtering, Airlink® ACSES does not require external filters. The high Adjacent Channel Rejection (ACR) and blocker performance is due to the SAW/Crystal filtering in an IF stage, the 16-bit ADC which can maintain a high-quality signal even in the presence of a high-power interferer and a brick wall digital filter which removes the remaining out-band interference.

Airlink® ACSES has an internal Power Amplifier (PA) capable of supporting a 50% duty cycle at a maximum transmit power of 25 Watts. The PA has the linearity needed to run the highest modulation (64QAM) at full power. The Airlink® ACSES also includes a Trusted Platform Module (TPM) which supports hardware secured boot and secured storage. The product employs X.509 EAP TLS authentication. Airlink® ACSES supports OTA 3-way handshake key management and AES256 encryption.

Airlink® ACSES can serve as both an IEEE802.16-2017 point to multipoint base station or remote station. In both roles, Airlink® ACSES acts as an Ethernet learning bridge with Ethernet frames being forwarded end to end. As an IEEE 802.16-2017 base station, Airlink® ACSES manages QOS profiles for all remotes within its serving area. The QOS profiles incorporate many QOS parameters, including scheduler type, priority, Minimum Sustained Rate (MSR), and many others.

GENERAL RADIO SPECIFICATIONS

Frequency Range – ACSES Mode	216 MHz to 222 MHz
Frequency Range – 802.16t Mode	70 MHz up to 6 GHz
TX Power	44 dBm @ antenna port (25W)
Duplex Method	HD-FDD, TDD

ACSES MODE SPECIFICATIONS

Channel Sizes	12.5 kHz
Throughput	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).

802.16t MODE SPECIFICATIONS

Channel Sizes	5 kHz to 50 kHz
Throughput	Up to 150 kbps
Topology	Point to MultiPoint, Direct Peer-to-Peer (DPP)
RX Sensitivity	As low as -126 dBm
Waveform	Multi-carrier
Air Interface Protocol	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 ≥ ±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 40C non-condensing
Dimensions	8.0" x 5.2" x 2.0" (203mm x 132mm x 51mm)
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 1PPS 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, 50Ω.
LEDs	Power, Radio Status, Radio TX, Radio RX, Eth1 Status/Activity, 2 x spare (API configurable)

SECURITY FEATURES IN 802.16- 2017 MODE

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

COMPLIANCE

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

Specifications subject to change.