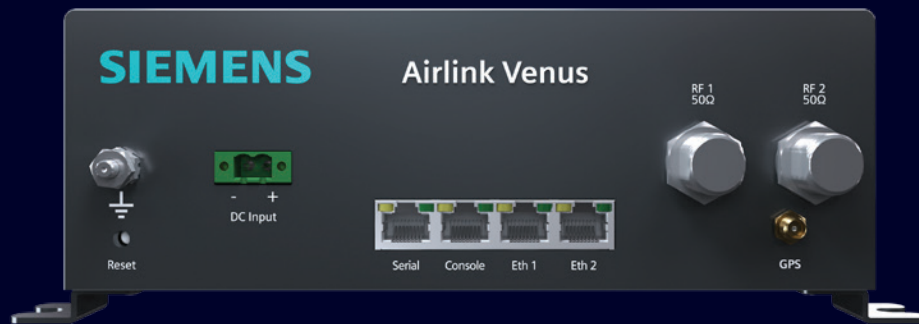


SIEMENS



Airlink[®] MC-IoT

Wireless Communication System

usa.siemens.com/mobility

Airlink MC-IoT

Airlink MC-IoT is a wireless communication system for industrial, mission critical Internet-of-Things (MC-IoT) from Siemens Mobility, Inc.

Airlink MC-IoT complies with IEEE 802.16-2017 to deliver secure, wide area, broadband, end-to-end IP connectivity for mission critical rail operations. IEEE 802.16-2017 is the standard for air interface for broadband wireless access systems and the only standard developed specifically to serve mission critical industries and not the consumer market.

Consisting of a family of software-defined base station and remote radios with unique capabilities to minimize overhead and to maximize data throughput, Airlink MC-IoT enables

Standards-based, secure, end-to-end IP connectivity for wireless networking

railroad operators to realize a substantial reduction in the amount of spectrum required to enable current & future applications.

The combination of high transmit power, excellent receiver sensitivity, flexible channel sizes and frequencies, allows for exceptional range in a point-to-multipoint wireless data system with non-line-of-sight connectivity for 30+ miles.



Standard, Advanced Over-the-Air Protocol

Unique capabilities that significantly increase efficiencies in licensed frequency channels

- Standards-based—complies with IEEE 802.16 to ensure an ecosystem with multiple vendors
- IEEE 802.16 is the only standard developed specifically to serve mission critical industries—not the consumer market
- Extension of the corporate intranet—standard Internet Protocol enables VPN, VLAN and any other IP-enabled application
- Wide range of dynamically selected high-order modulation and error coding based on RF conditions
- Configurable channel sizes with support for wide channels (up to 10 MHz) and flexible bandwidth allocation for efficient spectrum utilization
- Combine non-adjacent channels with spectrum aggregation to maximize bandwidth
- For maximum frequency reuse, Time Division Duplexing (TDD), allows uplink and downlink data rates to be set independently over a single channel
- Highly configurable Quality of Service based on payload data allows for reliable, well tuned network performance



Airlink Mercury Top View

State-of-the-Art, Software-Defined Radio (SDR) Platform

- Frequency agnostic with software-defined radios (70 MHz to 6 GHz)
- Future proof—implement multiple over-the-air waveforms, protocols for migration from legacy networks or as needs evolve
- Flexible analog front end in frequency range, channel bandwidth and other radio parameters
- Encryption, authentication, and authorization for secure operation
- Edge processing capabilities allows for implementation of third-party requirements onboard the radio
- Capable of being updated and configured remotely
- Extensively tested in drive and flight operation



Airlink Mercury Side View

Security

- AED 256 traffic encryption
- Three-way handshake over-the-air rekeying
- 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 protection and access rights limitation for security robustness
- Trusted updates: authenticated and validated upgrades and configuration changes
- Security patch management
- Secured SNMPv3 remote management
- SSHv2 local management
- Security events monitoring—audit ready

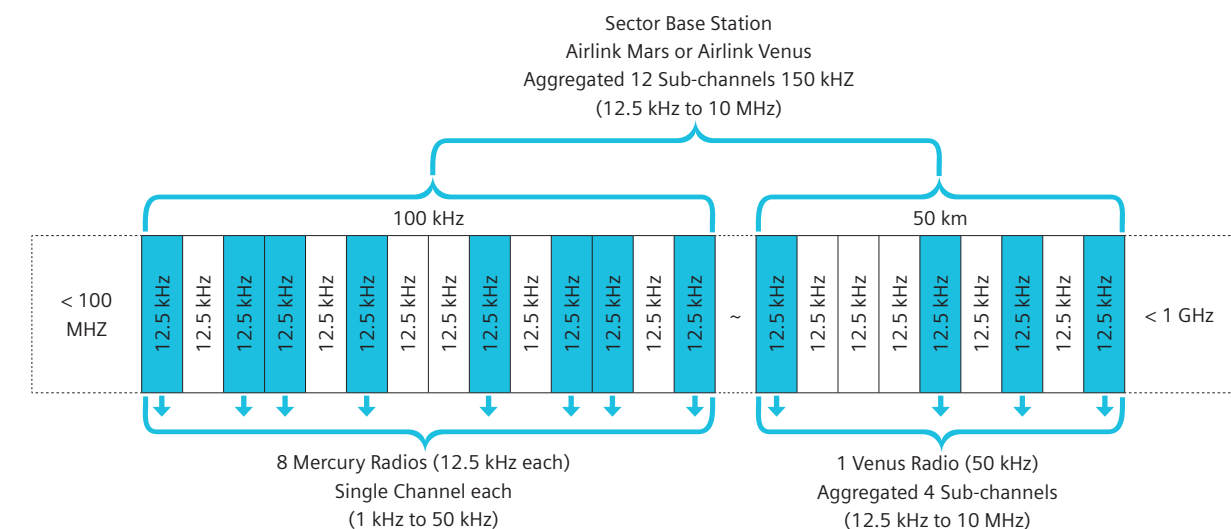
Flexible Channel Sizes and Spectrum Harvesting

Maximize bandwidth flexible channel sizes and spectrum harvesting

The bandwidth available in a sector may consist of a contiguous band or an aggregation of multiple adjacent or non-adjacent channels, including Private Land Mobile Radio (PLMR) channels.

The sector bandwidth is partitioned into multiple sub-channels. When the sector bandwidth consists of multiple adjacent or non-adjacent channels, the individual channels will be configured as sub-channels.

Airlink Mars and Airlink Venus base station radios will operate over the entire channel, Airlink Venus (as an end-point) will operate over multiple sub-channels. Airlink Mercury will operate over a single sub-channel.



Airlink Software-Defined Radios

State-of-the-art, point-to-multipoint, wireless radio system for secure, licensed, private, IP-enabled, broadband networks for mission critical rail applications.

Airlink Mercury

Ultra-compact, low-cost remote radio that is an ideal alternative to cell/satellite endpoints

Airlink Mercury is an ultra-compact, low-cost, fixed/mobile endpoint radio for wireless data communications in mission critical railroad applications. Airlink Mercury connects to Airlink Venus and Airlink Mars base station radios in standard narrow channel sizes.



As a foundational low-cost building block within a Point-to-Multipoint (PtMP) multicell, multisector wireless radio system, Airlink Mercury is designed to serve low-throughput endpoints with low power budget requirements.

With superior receiver sensitivity and support for narrower transmit channels (as low as 1 kHz), Airlink Mercury ensures maximum range in challenging RF environments even at lower transmit power.

Airlink Mercury's low power consumption allows for deployment in Mission Critical IoT (MC IoT) applications using battery and solar power supplies.

Low-data rate and multi-protocol intelligent devices or sensors may be deployed at massive scale with hundreds of Airlink Mercury radios operating on a single base station.

Airlink Venus

Versatile base station and remote radio with edge computing capability

Airlink Venus is a versatile radio that may be programmed either as a base station or as a fixed/mobile endpoint. As an endpoint radio, Airlink Venus connects to either an Airlink Mars or an Airlink Venus base station and provides greater range and higher throughput capability compared to Airlink Mercury.

Airlink Venus, a software-defined radio, supports any frequency band from as low as 70 MHz up to 6 GHz and flexible channel sizes ranging from as narrow as 12.5 kHz up to 10 MHz.

Airlink Venus supports transmit power up to 4 Watts (36 dBm) at the antenna port with exceptional receiver sensitivity as low as -119 dBm.

Airlink Venus offers a powerful platform for edge computing capable of running an embedded Docker container with custom applications designed to improve response times and reduce RF spectrum demand.



Airlink Venus
Top View

Airlink Mars

High-performance, high-power base station, fixed remote or mobile remote radio

Airlink Mars is a high-performance radio that may be configured as a base station or as a fixed/mobile endpoint. Typically serving as a high-power base station in a point-to-multipoint RF network, Airlink Mars connects to Airlink Mercury, Airlink Venus, and Airlink Mars endpoint radios.

Airlink Mars, a software-defined radio, supports any frequency band from as low as 70 MHz up to 6 GHz and flexible channel sizes ranging from as narrow as 12.5 kHz up to 10 MHz.

Airlink Mars supports transmit power up to 100 Watts at the antenna port with exceptional receiver sensitivity as low as -119 dBm. This provides the flexibility to match legacy system RF coverage and utilize existing infrastructure.

Operating as a base station, Airlink Mars' advanced processing power can handle narrow channel Airlink Mercury and narrow/wide channel Airlink Venus remote radios simultaneously thereby allowing operators to scale data rates based on the application and location of the remote radios.



Airlink Radio Specifications

		AIRLINK MERCURY	AIRLINK VENUS	AIRLINK MARS
Radio Specifications	Frequency range	100 MHz to 1 GHz	70 MHz to 6 GHz	70 MHz to 6 GHz
	Channe sizes	1 kHz to 50 kHz	12.5 kHz to 10 MHz	12.5 kHz to 10 MHz
	Throughput (depends on channel size)	Up to 150 kbps	Up to 30 Mbps	Up to 30 Mbps
	Transmit power (at antenna port)	Up to 25 dBm	Up to 36 dBm	Up to 50 dBm
	Receiver sensitivity	-125 dBm @ 12.5 kHz; -122 dBm @ 25 kHz; -119 dBm @ 50 kHz	-119 dBm @ 12.5 kHz	-119 dBm @ 12.5 kHz
	Waveform	OFDMA	OFDMA	OFDMA
	Modulation	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM
	FEC downlink	Convolutional Coding (CC) with rates 1/2, 2/3, 3/4	Convolutional Coding (CC) with rates 1/2, 2/3, 3/4	Convolutional Coding (CC) with rates 1/2, 2/3, 3/4
	FEC uplink	Convolutional Turbo Coding (CTC) with rates 1/2, 2/3, 3/4, 5/6	Convolutional Turbo Coding (CTC) with rates 1/2, 2/3, 3/4, 5/6	Convolutional Turbo Coding (CTC) with rates 1/2, 2/3, 3/4, 5/6
	Duplex method	Time Division Duplexing (TDD)	Time Division Duplexing (TDD)	Time Division Duplexing (TDD)
	Topology	Point-to-MultiPoint	Point-to-MultiPoint, Point-to-Point	Point-to-MultiPoint, Point-to-Point
	Air interface protocol	Band AMC 1x6 as per IEEE 802.16 s for channel bandwidth > 12.5 kHz	Band AMC 1x6 as per IEEE 802.16 s for channel bandwidth > 12.5 kHz	Band AMC 1x6 as per IEEE 802.16 s for channel bandwidth > 12.5 kHz
	Modulation coding scheme (MCS) selection	Dynamically adjusted	Dynamically adjusted	Dynamically adjusted
	QoS	Best effort, real time polling service	Best effort, real time polling service	Best effort, real time polling service

Physical Characteristics	RF Antenna	50 ohms	50 ohms	50 ohms
	GPS	Active 5 VDC	Active 5 VDC	Active 5 VDC
	Power input	12-13.3 VDC	18-60 VDC	48 VDC +/- 25%
	Date interface	100 Base T, RS232	100 Base T, RS232	100 Base T, RS232
	Power consumption	Less than 10 W	30W (1.25A @ 24 V input) Peak	350 W
	Indicators	Power On, Error and Link status	Power on, LCD panel	Power on, LCD panel
	Dimensions	6.6 in x 4.8 in x 1.6 in 168 mm x 122 mm x 41 mm	9.9 in x 4.8 in x 3.3 in 252 mm x 122 mm x 84 mm	19 in x 3.5 in x 16 in 483 mm x 89 mm x 407 mm
	Weight	2 lbs. 8 oz 1.14 kg	4 lbs. 2 oz 1.9 kg	15 lbs 14 oz 7.2 kg
	Enclosure protection rating	IP50 (Optional IP65)	IP50	
	Operating temperature	-40 °C to + 75 °C	-40 °C to + 70 °C	-40 °C to + 70 °C
	Cooling	Passive (no fan)	Passive (no fan)	Forced air (front-to-back)
	Mounting	Various	Various	19 in U2 rack mount

		AIRLINK MERCURY	AIRLINK VENUS	AIRLINK MARS
Connectors/ Interfaces	DC Input	Phoenix 1777989	Phoenix 1777989	Phoenix 1777989
	Grounding terminal	10-32 thread screw	10-32 thread screw	10-32 thread screw
	Serial Data	RJ45	RJ45	RJ45 RS232/RS449
	Console CLI (Cisco serial)	RJ45	RJ45	RJ45
	Ethernet	RJ45 (10/100 Mb)	RJ45 (10/100 Mb) x2	RJ45 (10/100 Mb)
	Antenna port RF1	SMA Jack female (50 ohms)	Type N female (50 ohms)	Type N female (50 ohms)
	GPS	SMA Jack female	SMA Jack female	SMA Jack female
	LCD display		16x2 backlit	16x2 backlit
Compliance		IEEE 802.16-2017 IEEE 1613-2009 Class 1 Div 2	IEEE 802.16-2017 IEEE 1613-2009 Class 1 Div 2	IEEE 802.16-2017 IEEE 1613-2009



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