ONDAS
N E T W O R K S

Airlink WCP

User and Installation Guide

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<div style="border: 1px solid red; color: red;">

Warning: Never power on a Airlink WCP without a load on the RF connector.

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1   FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by Ondas Networks could void the user's authority to operate the equipment.

2   FCC Exposure Statement

This equipment complies with the FCC RF radiation exposure limits set forth for a controlled environment. This transmitter must follow the specific operating instructions for satisfying RF exposure compliance.

The maximum gain antenna to be used with this equipment is 19 dBi. So equipped, this transmitter must be at least 9.1 meters from the user and must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

*   Reorient or relocate the receiving antenna.

*   Increase the separation between the equipment and receiver.

*   Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

*   Consult the dealer or an experienced radio/TV technician for help.

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Ondas Networks may void the user's authority to operate the equipment.

3 ISED Canada

3.1 Statement

This device complies with Innovation, Science and Economic Development Canada's license-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and

2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux flux RSS exemptés de licence d'Innovation, Science et Développement économique Canada. L'opération est soumise aux deux conditions suivantes:

1. Cet appareil ne doit pas provoquer d'interférence; et

2. Cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

3.2 Radiation Exposure Statement

This equipment complies with the IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 9.1 meters between the radiator and your body.

Énoncé d'exposition aux rayonnements: Cet équipement est conforme aux limites d'exposition aux rayonnements ioniques RSS-102 Pour un environnement incontrôlé. Cet équipement doit être installé et utilisé avec un Distance minimale de 9.1 metres entre le radiateur et votre corps.

4   Physical Installation

4.1   Introduction

A Airlink WCP radio is comprised of software and hardware which is packaged in an indoor enclosure intended for mounting in a 19" rack or directly attached to a wall board.

4.2   Airlink WCP Enclosure

4.2.1   Specifications

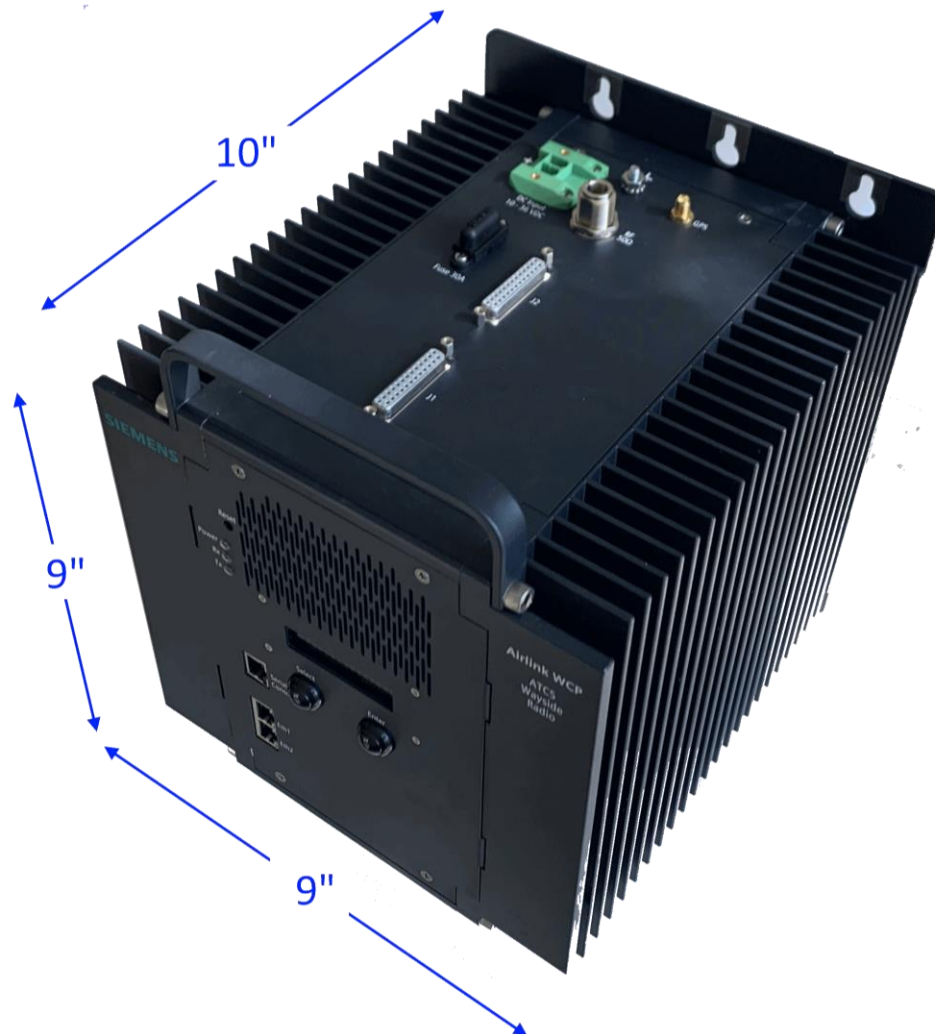| Enclosure Material	Aluminum Alloy
Dimensions (W x D x H)	9" x 9" x 10" (230mm x 230mm x 255mm)
Operating Temperature	-40° F to 158° F (-40° C to 70° C)
DC Input Power Range	10 to 36 VDC Nominal voltage 24VDC
Power Consumption	No load : 100 watts @ 24 VDC Peak load : 150 watts @ 24 VDC

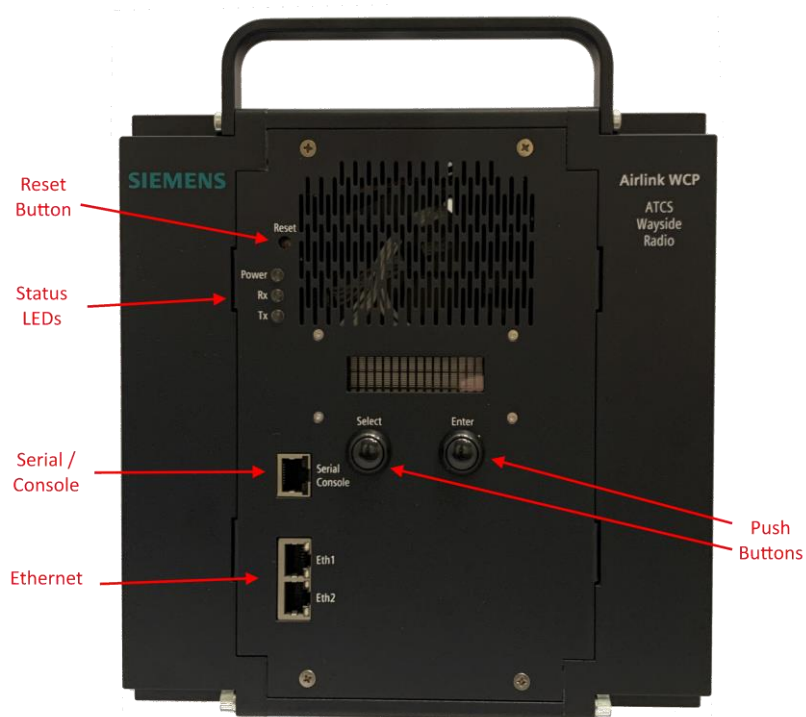### 4.2.2   Product Overview

Figure 1 ; Airlink WCP Overview
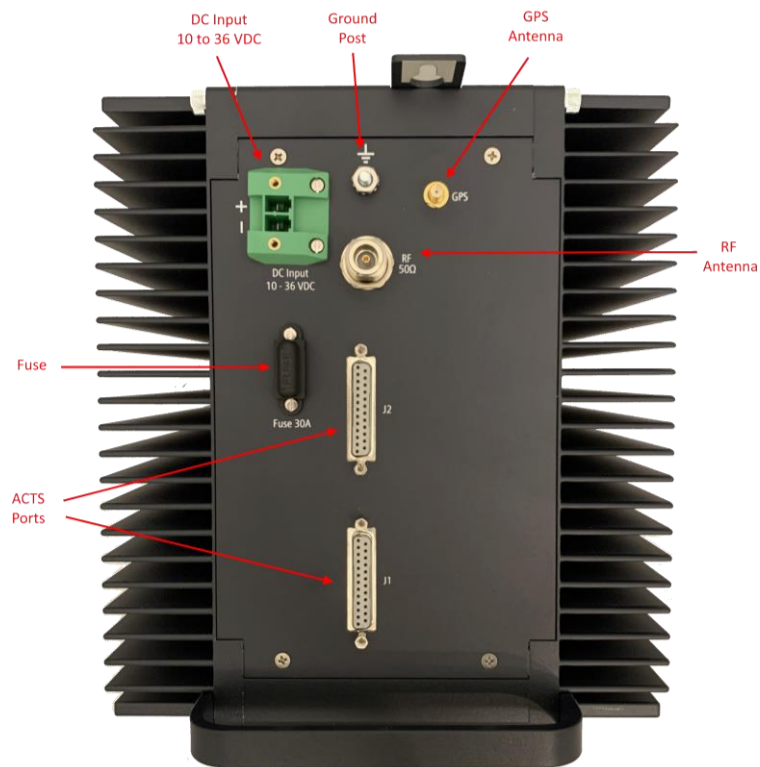
Figure 2 : Airlink WCP Front Panel

Figure 3 : Airlink WCP Top Panel

4.2.3 Connection Descriptions

Connector	Application
GPS Antenna	SMA female connector for optional GPS antenna.
RF Out	50Ω N-Type female connector for RF input from antenna
DC Input	DC power input 10 to 36 volts. Warning: Ensure Correct Polarity
Ground Post	Connection to building ground
Fuse	30 amp Fuse
ATCS Ports	2 x DB25 female connectors for ATCS data
Ethernet	2 x RJ45 connector for Ethernet 10/100 Base-T interface
Console / Serial	RJ45 8-pin connector wired using the Cisco interface specification for serial access and console access via an adapter cable
Reset Button	Recessed access to system reset function
Push Buttons	Select and Enter functions for user interface

4.2.4   Mounting Guidelines

The Airlink WCP can be mounted in a purpose built rack using the teardrop pin mounting cutouts, or attached to a wall board as described below.
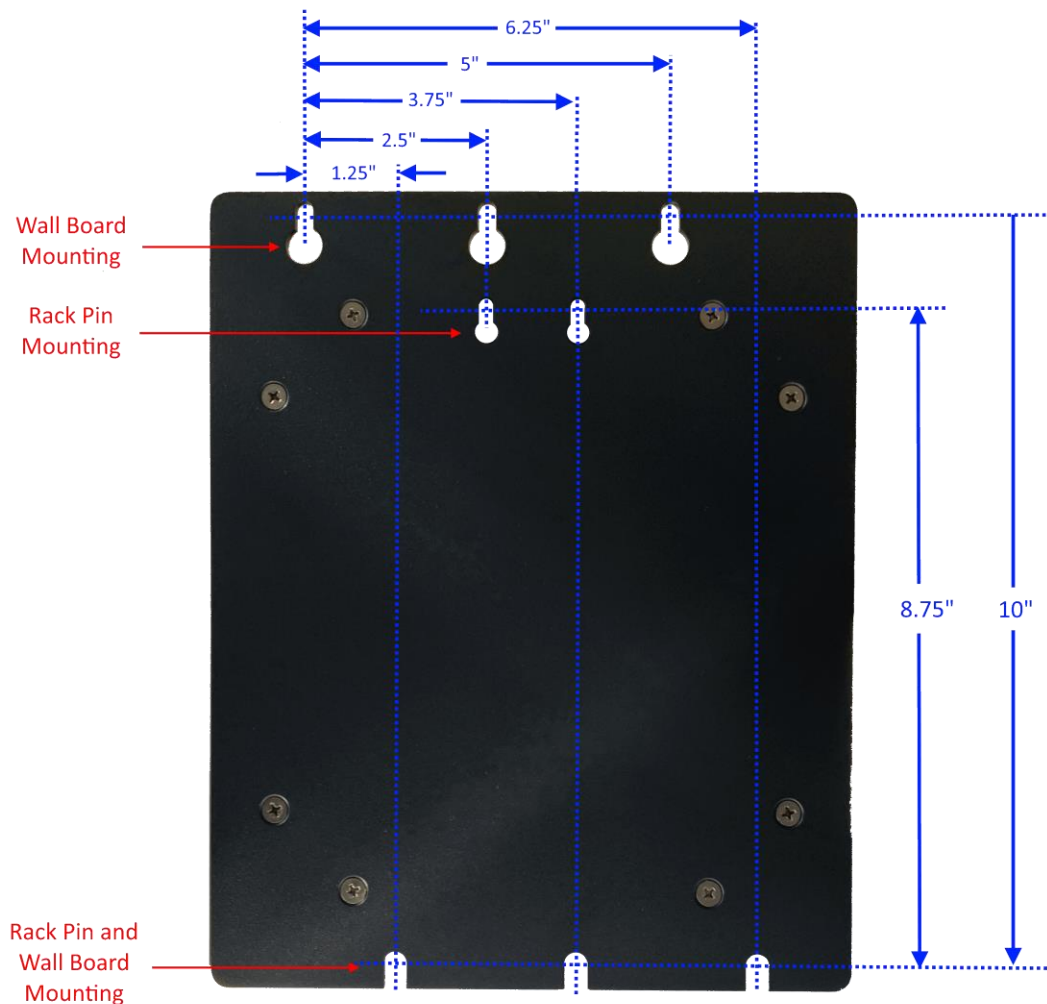

Figure 4 : Airlink WCP Mounting Dimensions

5 System Overview

Airlink WCP may operate in ATCS Mode as a Mobile Station, or in MC-IoT mode as a Base Station or Mobile Station as defined by FCC Part 90 (§90.7).

5.1 ATCS Operation

The Airlink WCP makes up a wayside communications package, including the radio and associated software/hardware that enables the transmission of ATCS datagrams from the WIU to the BCPs and vice-versa. It will function as per the standards that are defined in S-9553.V1.0 & S-9553A.V1.0
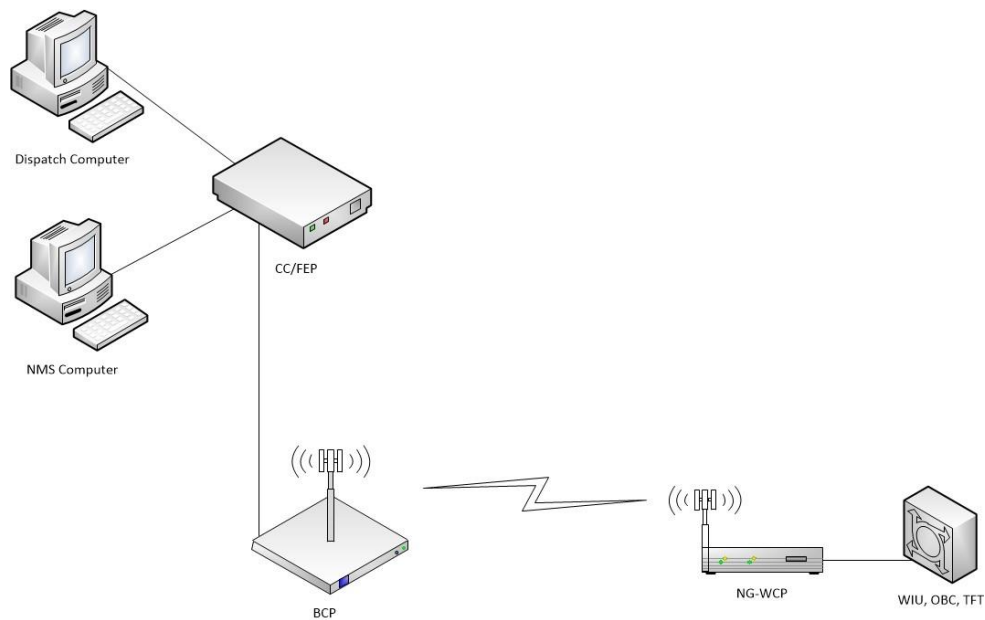

Figure 5 System Overview

Airlink WCPs will interoperate with the existing Siemens BCP infrastructure. It provides a standard interface to the data network for a wide variety of user devices.

Airlink WCP shall be used to perform the following general functions,

- Provide the interface between Base Communication Package (BCP) and Wayside device Interface Unit (WIU)
- Deliver ATCS messages to and receive messages from BCP via an RF link
- Deliver ATCS messages to and receive messages from WIU via the serial ports and a local network interface
- Deliver ATCS messages to and receive messages from a Network Management System in the office.

5.2   MC-IoT Operation

In MC-IoT mode the Airlink WCP may operate as a Base Station or Mobile Station in a point-to-multipoint network and employs Ondas Networks' FullMAX technology.

FullMAX is a multi-cell, Point-to-Multipoint (PtMP) broadband wireless system based on the IEEE 802.16 standard with modifications to enable its operation in a wide range of frequencies and a wide range of channel sizes. The system is used to establish a private, broadband wireless service for mission critical industries. FullMAX supports both fixed and mobile applications.

The main characteristics of the FullMAX System include the following:

FullMAX employs HD-FDD or TDD framing to provide greater flexibility and to maximize spectrum utilization.

FullMAX is capable of operating in any frequency band between 40 MHz and 6 GHz and in any channel size between 12.5 kHz and 5 MHz. FullMAX can be configured to operate in a downlink to uplink ratio to support symmetrical, asymmetrical and reverse asymmetrical applications.

The FullMAX system offers the private system operator wide area coverage by leveraging the following:

- High transmit power from both the Base Station and Remote Stations

- Exceptional receiver sensitivity

- Superior propagation due to the operation in narrower channel sizes and low band frequencies

The FullMAX system offers excellent frequency utilization through the following capabilities:

- Adaptive Modulation and Coding per link in both the downlink and uplink

- Optimization of the downlink and uplink ratio for the user's main applications. For example, in the case of SCADA applications, the FullMAX frame is configured as reverse asymmetrical, i.e., more bandwidth is allocated to the uplink than to the downlink.

- Modifications to the standard air interface protocol to minimize MAC layer overhead.

- Employ Band-AMC subcarrier allocation scheme in both uplink and downlink direction to maximize the percentage of data transport subcarriers.

- Packet Header Suppression (PHS) with the following characteristics:
    - Compressible header field values are learned automatically with no need for manual configurations.
    - Support for multiple compressible values for the same header fields. As a result, PHS can be used even when the header fields are not constant.

FullMAX includes a versatile set of Quality of Service (QoS) tools that can optimize traffic performance for each application and prioritize access to the available bandwidth according to the operator's requirements. QoS tools include various scheduling methods (e.g., Best Efforts and Unsolicited Grant Service), service flows with various QoS parameters such as priority level, minimum and maximum traffic rates, guaranteed delay, jitter, etc.

FullMAX provides secure connections with strong encryption (AES-128 or AES-256), strong authentication (EAP after RSA with X.509 certificates) and advanced key management protocol (PKMv2).

FullMAX supports various frequency reuse methods including:

- Traditional full channel based frequency reuse

- OFDMA based Band-AMC sub-channel reuse with up to 12 sub-channels in both uplink and downlink. Any combination of sub-channels can be used in each sector in both downlink and uplink.

FullMAX Remote Stations support a pre-configured channel acquisition plan, i.e., a preconfigured list of channel alternatives, characterized by center frequency, bandwidth, sub-channels and other parameters. During channel acquisition, the Remote Station goes through the list and evaluates the best alternative.

FullMAX has an advanced remote management system that enables the system operator to monitor, configure, manage, detect failures and diagnose problems. The FullMAX system configuration and FullMAX system provisioning support centralized management profiles.

The FullMAX system architecture consists of Base Stations, Fixed Remote Stations and Mobile Stations. Backhaul networking equipment connects the Base Stations to the customer's Network Operations Center (NOC) and the FullMAX Network Management System (NMS).

FullMAX Base Stations are typically installed in the existing Private Land Mobile Radio (PLMR) towers serving their respective cells.

The FullMAX Base Station is designed as a single sector device. Any number of sectors can be designed per tower, however the most common configuration is a three sector design with one Base Station unit per sector.

The sector configuration dictates the type of antenna that should be used. Typically a router is used at the tower to connect all Base Stations to the NOC via backhaul facilities. FullMAX Fixed Remote and Mobile Stations are deployed throughout the tower's serving area.

6   System Operation

An Airlink WCP radio automatically starts operation when the DC power is connected. The unit conducts a series of self-tests, the results of which are shown on the front panel display module.

Figure 6 : Pushbuttons and Display

Status information can be accessed using the "Select" and "Enter" pushbuttons to scroll through and select various aspects of the system. The information is shown on the front panel display module.

Basic connectivity with the network can be verified using the Command Line Interface (CLI) via the console connection as shown below…

```
operator@AirlinkWCP-$ show wcp measurement report
show wcp measurement report

-----------MEASUREMENT REPORT ----------------
RSSI                        : -105 (dBm)
Last Packet RSSI            : Not available
SNR                         : 7 (dB)
CBB Rx Gain                 : 25 (dB)
Configured Tx Power         : 45 (dBm)
CBB Temperature             : 29 (C)
RFM Temperature             : 0 (C)
RFM Detected Tx Power       : 0 (dBm)
RFM Detected Current Drawn  : 0 (mA)
```