AVIOLINK

Autotracking Microwave Receiving Antenna

Aviolink: Antenna Control Unit (ACU) and Azimuth Positioner assembly

1 Description

The Aviolink System is an antenna receiving equipment with a rotating antenna, which tracks an airplane, helicopter, ship, UAV, or any vehicle for remote surveillance.

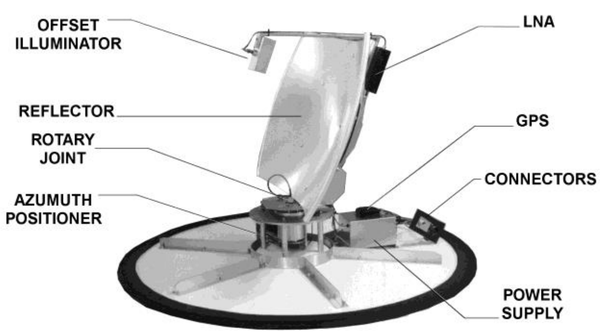
The vehicle to be tracked transmit its position with a GPS receiver linked to the on-board video transmitter.

This signal is received by the Aviolink unit which computes the required tracking angle using a GPS installed in the antenna. The antenna assembly uses a squared cosecant shaped reflector with an offset illuminator.

The elevation coverage of a sector from 0 to 10 degrees above horizon remains constant over the operating band. Full 360° degrees coverage is assured without cable wrap, thanks to a rotating joint.

A low-noise amplifier is provided, and switched on when a certain distance (programmable) is reached.

The control unit can be completely remote controlled, so receiving installations does not require human operators. System is available in a radomized version, and in an open-version, suitable for shelter installations.



ODU Internal Description

2 The System

The system is composed by a receiving antenna, placed inside a dielectric radome (ODU: Out-Door Unit) and a control unit (ACU: Antenna Control Unit).

The antenna (2400 to 2700 MHz in the vertical polarization), is composed by a section of the parabolic reflector, an illuminator, and a low noise amplifier (LNA) switchable as desired.

The positioning of the illuminator has been optimized so as to achieve a diagram, in the vertical plane, of cosecant square type (csc2).

Antenna Control Unit (ACU): front view

The antenna is positioned on a rotating base, driven by a DC motor, and equipped with a rotary joint that allows the system to be able to track continuously an aircraft.

The position is detected by an high resolution incremental encoder.

The whole system is supervised by the antenna control unit (ACU) which contains the main processor, the user interface (keypad and LCD) and the power supply.

The control unit of the receiving antenna is supplied in a 19" rack (2U), and has a user-friendly interface thanks to a backlit LCD display and customized keyboard.

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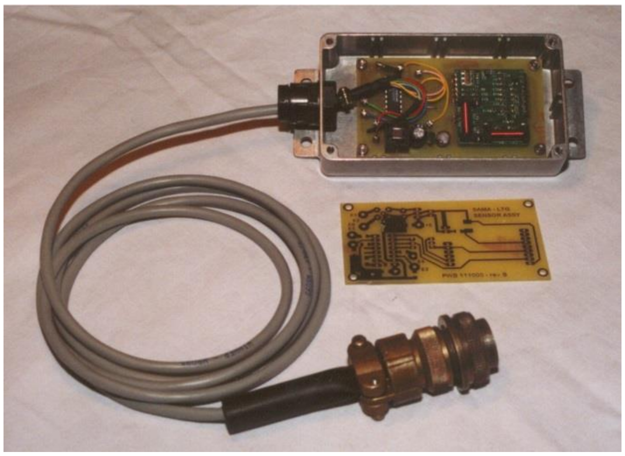
The processor controls all the pointing functions thanks to the data provided by the GPS telemetry coming from the collaborative aircraft.

These telemetry data include the location and altitude of flight, and are used to perform the tracking.

The coordinates of the receiving station and the orientation of the station are inserted automatically or manually, using data-entry during the installation of the system.



Magnetic Compass for automatic antenna alignment

3 Functional Description

The Aviolink is based on the following concept: the tracked aircraft transmits its GPS location via radio channel (datalink), according to the standard NMEA format.

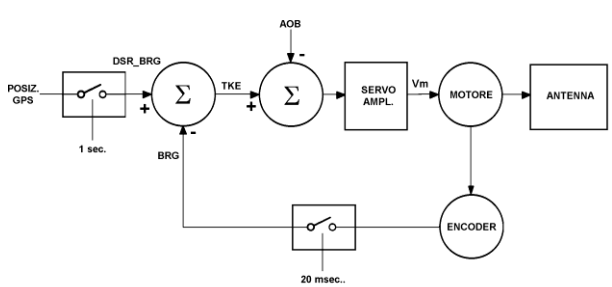
This format is composed of a series of strings (sentences) that define the parameters such as the position (latitude, longitude, height, speed, etc.) all transmitted in ASCII code at 4800 bps.

The ACU receives this information, and continuously calculates the position of the aircraft based on knowledge of the GPS position of the receiving antenna.

The calculation is performed using an algorithm of spherical trigonometry, which allows you to find the angle between two points defined by their coordinates LAT / LON.

3.1 Tracking servo system

The angular position thus calculated is sent to a servo system that provides to drive the motor antenna (ref. following image). The desired position is compared with the actual location of the antenna and the error: the system provides the correct drive voltage for the servomotor.



Servo system block diagram

The figure also indicated a further signal, AOB. This is introduced manually during the tracking, to compensate for internal errors (offset pointing, installation, etc.).

The system is furthermore complex because of the telemetry information give directly the speed and the angular acceleration of the aircraft with respect to the receiving station.

Also, consider that the GPS sensor updates position data every second so the software continuously generates the pointing data (propagator of position) during the intervals between an update and the other, to ensure a smooth movement of the antenna.

The controller is based on a simplified PID algorithm, which operates in discrete time, realized by a digital processor.

The position of the antenna is sampled every 20 msec. The integrator present in the control system is reset every 6 seconds if no signals are received telemetry valid (anti wind-up).

4 Specifications

Frequency range (other bands available on request)	**2.4 – 2.7 Ghz**
Polarization (E)	**Vertical**
Antenna gain	**> 25 dB**
Beamwidth, -3 dB Azimuth Elevation	**8 ° deg 10 ° deg**
Sidelobes	**< 15 dB**
LNA noise figure	**< 1 dB @ 2.5 GHz**
LNA Gain	**> 35 dB @ 2.5 GHz**
Max tracking speed	**10 deg/sec**
Azimuth position resolution	**0.1 deg**
Mating connectors	**RF: type-N (F) Control: MIL-C 10 pinF)**
Antenna GPS sensor	**Sirf 12 channel – NMEA**
Radome	**Fiberglass**
Dimensions	**120 cm (H), 130 cm (Dia)**
Weight	**60 Kg.**

Processor	**80386 (40 MHz)**
Control loop	**Digital/analog servo system**
GPS Position data sampling	**1 sec**
Position Interpolator	**100 msec**
Antenna tracking sampling speed	**20 msec**
Display update	**100 msec**
Datalink	**NMEA 0183, 4800 bps.**
Signal interfaces	**RS-232**
Antenna assy power supply	**28 Vdc, max 2 A**
Dimensions, weight	**Rack 19", 2U.**
Power	**220 Vac – 100 VA max (option 115 Vac)**