

AWICS OWNER'S MANUAL

This owner's manual discusses the following products as part of an AWICS system:

Access Points
Wireless Routers
Base Units (AC & DC)
Remote Units (Indoor & Outdoor), (AC & DC)
Power Transformers
Splitters
Circulators
Solar Panels
Solar Batteries
Fiber Optic Cable
Antenna
Coax Cable

SAFETY

The following safety precautions are meant to prevent personal injury and damage to the equipment.

- 1.) Do not connect to any voltage source other than to the source recommended or indicated for each product. Verify correct polarity during installation.
- 2.) Do not operate the system units within the vicinity of lightning.
- 3.) Do not perform internal maintenance on the system's units. Only qualified technicians should perform maintenance on this product.

WARNINGS

Failure to follow safety precautions or proper installation instructions automatically void the manufacturers warranty.

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Components

With small to mid-sized airports in mind, Mentor Radio developed a low cost integrated communications system that is both expandable in both geographic coverage and system connections to meet this need. Figure 1 shows a fully implemented Airport Wireless Integrated Connectivity System (AWICS). The AWICS consists of two elements, fixed and mobile assets. Each of these elements can be used separately or together. When used together, they provide complete connectivity across an entire airfield supporting users of many types of equipment.

FIXED ASSETS

AWICS fixed assets consist of a Radio Over Fiber (ROF) system used to distribute radio signals to multiple locations. Even over very long distances. The maximum distance from the head end unit to a remote unit may be up to 3000 meters or 1.8 miles. Extending the maximum distance is also possible. The use of fiber optics allows signals from an existing network (LAN or wireless LAN – Wi-Fi) to be ‘spread out’ over a large geographic area allowing significantly expanded coverage. Fiber optic cable supports extremely wide bandwidth. Therefore, Mentor Radio’s AWICS system can support not only Wi-Fi systems, such as 802.11b/g, but, also any other existing radio systems (i.e. VDL Mode-2). This will allow dissimilar types of systems to be integrated into the users overall network structure while minimizing investment in new equipment.

The use of the ROF part of the AWICS extends LAN/Wi-Fi/Internet connectivity to every area of the airfield covered by remote ROF nodes. Each remote node provides coverage of a specific portion of the airfield area. Since all nodes connect to the same Wi-Fi router the entire area is connected to the same network. This offers several advantages over a non-ROF systems. First, with ROF there is no added layer of network complexity. In other words, there is no need for expensive access points, controller server computers or protocol handoffs. From the users perspective, movement through the coverage area does not result in connect/disconnect or a loss of connectivity. Secondly, this increased access to real-time information saves time and improves safety.

Expanding the system is simple. In order to increase your coverage area, simply connect a head end unit and a remote antenna unit to a new fiber optic cable. A single low cost connection at the router completes the upgrade.

MOBILE ASSETS

Mobile assets include base unit radios and vehicle mounted mobile radio units. These components have features that are very similar to systems that users are quite familiar with. They include AM voice radios for airport operations/ground support, FM voice radios for private communications (LMR), FM data radios for low frequency data transfer, and combination voice/data radios supporting established protocols, such as, P-25. The mobile assets will accommodate the following radio links: 118-136 MHz AM Voice, 118-136 MHz VDL Mode 2, 450-470 MHz FM Voice/Data, 450-470 MHz Tetra, 796-815 MHz Tetra, and 796-815 MHz P25. The radios will be outfitted with data interfaces that allow them to be used as ‘voice and data’ modems, operated via remote computers, and capable of supporting VOIP software.

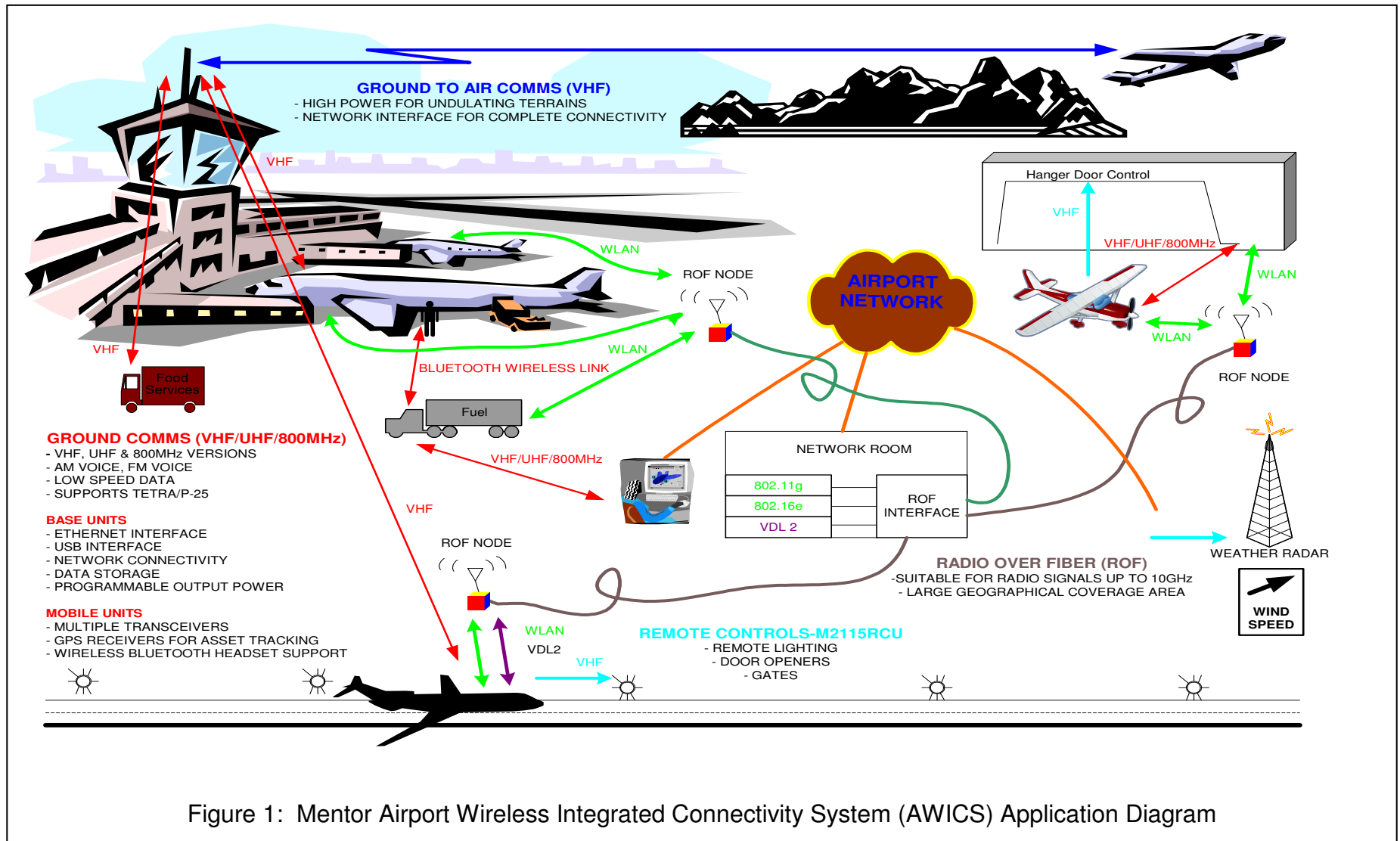


Figure 1: Mentor Airport Wireless Integrated Connectivity System (AWICS) Application Diagram

AWICS System and Component Description

Planning for an AWICS system is important to ensure maximum benefits are realized. A small network is one in which there is a single connection point to the internet such as a cable modem or a DSL modem. Usually this component is connected to a single wireless router with a cabled PC that is connected up to 4-8 RJ-45 ports for hard wired connections and the wireless port is used for all wireless connections. The wireless router may be configured for use with or without security enabled. For non-trivial data access, it is highly recommended to enable security at this point.

When connecting to a small network like this, you only need a low cost wireless router. It should support 802.11 a, b or g. This connection will require a circulator to connect to the AWICS base unit also.

A large network is one that has a defined network infrastructure, one where a large number of users need to access data simultaneously. These networks can be configured to connect Access Point units to outside networks. Network administrators can determine if their networks require using Access Point Units or if they can connect using a simple wireless router. AWICS allows connecting 1-N Access Points for any size network. Connecting AWICS to an Access Point Unit does not require connecting a circulator. Each Access Point Unit may be connected to 1-N number of Base Units/Remote Unit node pairs.

Access Point: Used to connect a network with an existing cabled infrastructure to an outside wireless network. Note that the access point has two antenna output connectors. (One Uplink, One Downlink)

Wireless Router: Used to connect a wireless network to a DSL or cable modem. The wireless router must be the type that has a removable antenna. Note that the wireless router is different from an access point in the antenna connection. On the wireless router the antenna is a single connection. You need to connect a circulator after any splitters in the system, but, before the Base Unit, as shown in Figure 2. Please note that most wireless routers that have removable antennas use reverse polarity antenna connectors. Adapters may be required to connect to standard coaxes.

Base Unit: This unit converts RF energy from the network into light energy and sends it down the fiber to a remote receiving unit where it's converted back to a radio signal. The Base Unit can be powered by DC or AC. To operate with AC power an AC-DC converter, such as an AWICS-XF, must be used. This power supply comes with an AWICS-BU-XF.

Remote Unit - Indoor (DC) - This indoor remote unit is in a non watertight enclosure powered by DC. To use AC power, an AC-DC power transformer such as an AWICS-XF must be used. The transformer should be capable of providing 12VDC with up to 3 watts of power.



Remote Unit - Outdoor (DC)

Remote Unit - Outdoor (Solar)

Splitter - Splits RF signal into multiple paths. A splitter is used to connect more than one node to the network.

Circulator: Used to convert the RF signal from a wireless router into a signal suitable for the AWICS base unit.

Antenna 2.4GHz 3": Normal Wi-Fi antennas use reverse polarity antenna connectors. You may need an adapter to connect your antenna to the RF cables, circulators and splitters.

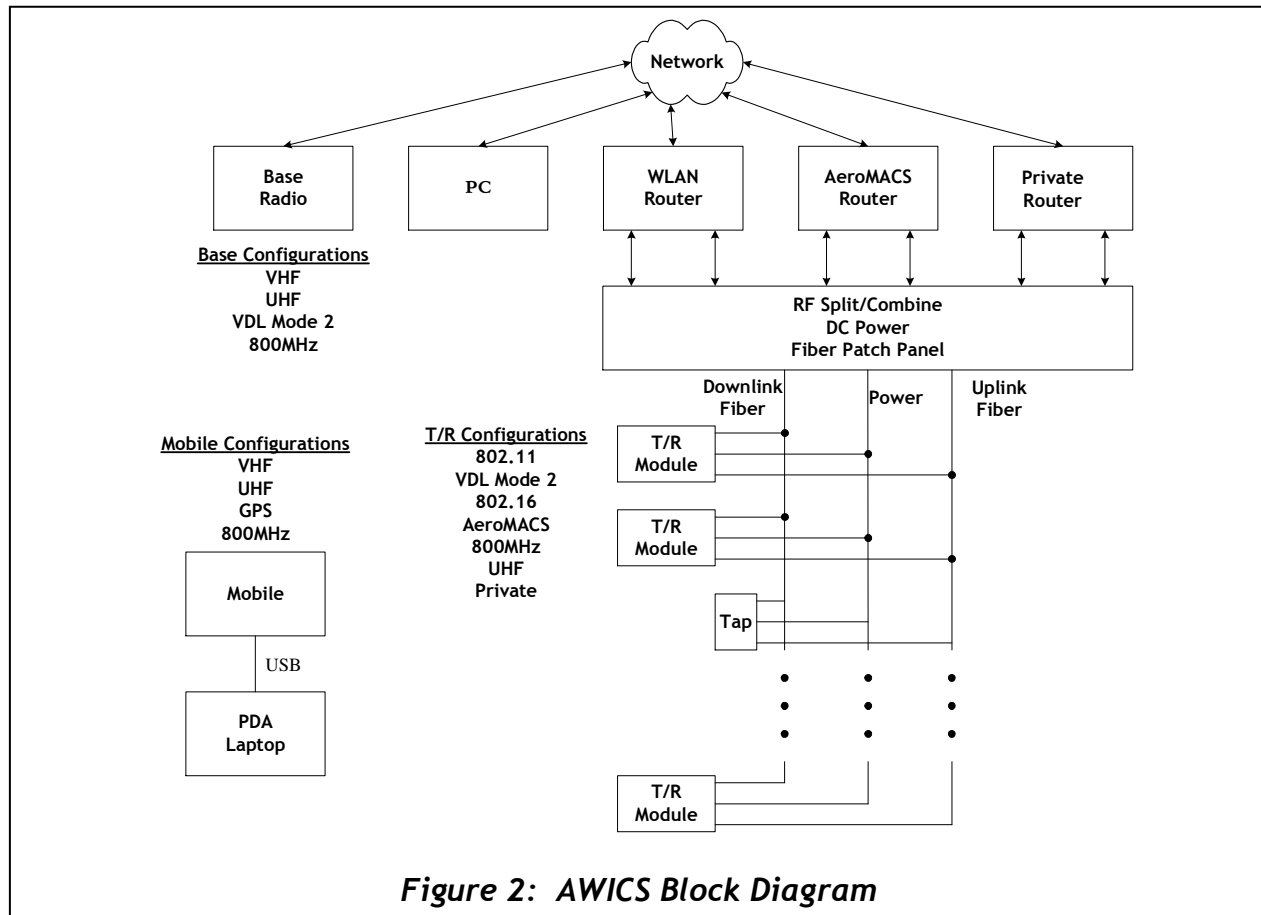
Fiber Optic Cable - Single mode fiber.

Fiber Optic Connector (SC)

Fiber Optic Connector (LC)

Fiber Optic Thru-Adapter (SC)

Fiber Optic Type SC to Type LC



Wireless Communications Components

With respect to Figure 2, the first part of the AWICS system that will be discussed is the analog voice/low data rate wireless applications represented by the Base Radio and Mobile blocks. These components have features that are very similar to systems that many users are quite familiar with. They include AM voice radios for avionics operations, FM voice radios for private communications, and FM data radios for low frequency data transfer, and combination voice/data radios supporting established protocols such as P-25 and Tetra.

Communications are established between a Base Unit positioned at a fixed location and a Mobile Unit placed in any number of locations, (ie. assets such as trucks, snow plows, lawn mowers, etc.) Where data systems are employed, peripherals such as PDA's and laptops can be connected to the Base and Mobile Units to allow information to be passed amongst these external devices through the radio network. Voice and data communications used within these networks stay in these networks, and can't be routed to users not directly connected with dedicated equipment.

There is one exception to this and that is for systems supporting the P25 or Tetra standard where data can be shared but the applications are not optimized/designed to fit the needs of airport operations companies. In addition, many of these products only use one frequency band so the ability to have communications with radios using the protocol standard, but not the same radio frequency, is impossible. To accommodate all the possibilities makes the cost of a fully integrated system quite high because all the extra hardware required. Even if all the equipment is purchased the system is still not tailored to the needs of airport based companies/operations.

The Mentor Radio AWICS system overcomes these obstacles and can support wireless voice and data (including established communications protocols), allows for the integration of the information through the Base Radio Units (BRU) standard interface ports. The BRU provides multiple interfaces (USB, Ethernet RJ45) for the user to connect to that allows various ways to integrate the mobile communications information into their network interface. Once at the network level, data can be available to any other user that has access to the network. In addition to the data connectivity, an interface at the network level allows for remote operation of the BTU from anywhere a user can access the network. The two capabilities make the AWICS system unique in that it provides a network interface for both data transfer and asset control.

For those users that only need basic, traditional, dispatch type of operation, the Base Unit comes with a microphone option that allows for basic voice communications with the lowest cost. With this configuration the user must manually operate the base station and there is no connectivity into the users existing network.

For those users that only need the basic dispatch style of operation, but want to place the base unit in a remote location, the base unit comes with a remote connection that is designed to interface to remote telephone style handsets. The handsets can be placed at convenient locations for operators while still allowing some access to the operational features of the system. The remote handsets can be configured to select up to four different frequencies of operation that is controlled by switch selections on the remote handsets.

The third option of base station interfaces is via a USB slave connection. Here the base unit is a USB slave device that acts as a peripheral to a PC or other USB master. In this mode, the base unit can be configured and controlled as part of a users' network if the USB master device is connected to the network. BTU control functions and data traffic is received from the USB port, interpreted by the base unit and routed to the appropriate destination. It also passes data from mobile station as well. The base unit acts as a router/interpreter to be able to allow devices with data capability to be integrated into a network/PC with a USB interface. The base also comes with a USB port with master capability that allows slave devices to be used as well. This includes devices such as PDA's, wireless headsets, and mass storage devices for saving data during emergencies for later analysis.

The final interface that the base units have is a full 802.3 Ethernet connection. This connection allows the base unit to be plugged into the users' network just like any other network plug in device (computers, printers, etc.). When being used in this fashion, the base unit can perform all the tasks that could be done via the USB port but with several major advantages. First is that the unit can be operated and controlled from any location where a person can access the network without requiring a PC connected to the base with accompanying software. This gives the user the ability to control the system and access data from anywhere. By being connected to the company's network, access to the base unit is possible (assuming the user is granted access). The second advantage is, in addition to remote data access, the base unit will have the capability to allow for voice operations through a VOIP (Voice over Internet Protocol) connection providing complete remote operation. This allows for the ultimate in flexibility and integration of wireless communication systems into user's networks. Users can operate the system and communicate with personnel at the airfield and at remote locations allowing for lower cost operations.

Along with the many interfaces the base unit can support, a brief mention of its radio capabilities will highlight some more of the versatility of the AWICS. Figure 2 shows a basic block diagram of the base unit (very similar to the mobile units). The design is based around two key features; transceiver modularity and second information is passed within the unit as digital data (voice as well). The modularity approach allows users to select the base to mobile connectivity by frequency and functionality. This lets the user build a system that fits their present need, while allowing for growth/change if and when it is needed. Upgrading is accomplished by purchasing transceiver modules and not entire base stations. Therefore, customers only need to purchase what they need at the present time and not have to spend money on functionality that they never end up using. Secondly, radio modules will be available that accommodate existing frequencies and protocols of several standards so users can continue to use their existing equipment and only upgrade the base unit. It also allows users to purchase future mobile equipment from whatever supplier meets their need and cost targets without having to replace large amounts of equipment at a single time. Of course Mentor Radio will have equipment to choose from, but Mentor Radio believes in making cost effective systems for users and not forcing them into locking into a single supplier's equipment. Transceiver modules that the user will have to choose from are:

***118-136 MHz AM Voice
118-136 MHz VDL Mode 2
450-470 MHz FM Voice/Data
450-470 MHz Tetra
796-815 MHz Tetra
796-815 MHz P25***

The second benefit of this architecture is that all the modules are connected via a digital data bus inside the base unit and this allows for two important features. First is that this allows a single microprocessor interface to control all the transceiver modules. In addition, the microprocessor can combine/mix/parse all the transceivers inputs and outputs in a manner determined by the user. Secondly, and extremely valuable, is that by having all the internal information in a digital format, the base unit can perform interpreter functions allowing systems with different data protocols and data rates to communicate with each other and provide data to users connected to the base unit. This function makes it much easier, if not presently impossible, to allow wireless systems to be integrated into a users network allowing all their wireless mobile systems to be connected and interoperable.

Base units, along with their flexible interconnects, have flexibility with respect to the number of transceivers that can be installed. The lower cost configurations will have the capability to install one or two transceivers where the more expensive units will have the ability to install up to six transceivers. The default operation when there are multiple transceivers present is that a PTT for any transceiver is the highest priority, but while no PTT is present all the receive audios are multiplexed together and routed to the end location (speaker or digital audio to a USB or Ethernet port). The transceiver that transmits on a PTT will be selectable by the operator of the base unit. In the case that there are multiple data radios in the base unit, a priority scheme will be established with a simple collision avoidance to allow data to flow to and from the base unit to all users in the system.

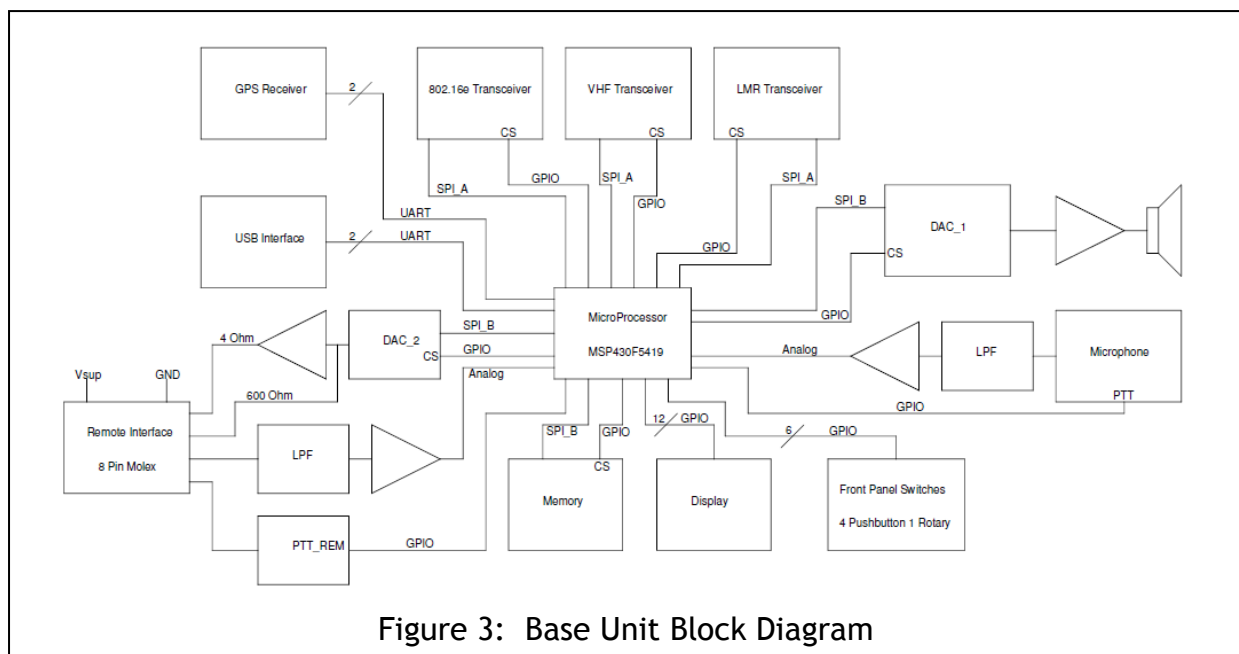


Figure 3: Base Unit Block Diagram

The AWICS mobile units will support AM voice, VDL Mode 2 data, FM voice, and low speed data using typical FM and PSK formats. Versions will be available that support established protocols/frequency bands for TETRA and P25. If the mobile is configured for data applications, then additional data from other types of systems, such as GPS receivers used for asset tracking can be integrated into the AWICS system. This provides users with many options as to what type of information can be exchanged between the base and mobile units.

The mobile units will have the option for two transceivers, of the users' choice, and if one of the transceivers supports data transfer then the ability to support other data options can be added as well. The transceivers will be combined in a single housing so that only one radio is required per vehicle. This lowers the complexity for users because there will only be one interface (microphone, volume, squelch, etc.) radio to deal with, and data applications will be managed by the mobile hardware. In addition to the transceiver options, the mobile units will have a USB master port that can be used to either integrate data devices such as PDA's or for wireless headset applications (using a Bluetooth wireless adapter). The mobiles will also have a USB slave interface so a data device that is a USB master (Laptop PC's) can be integrated in the network as well.

Theory of Operation

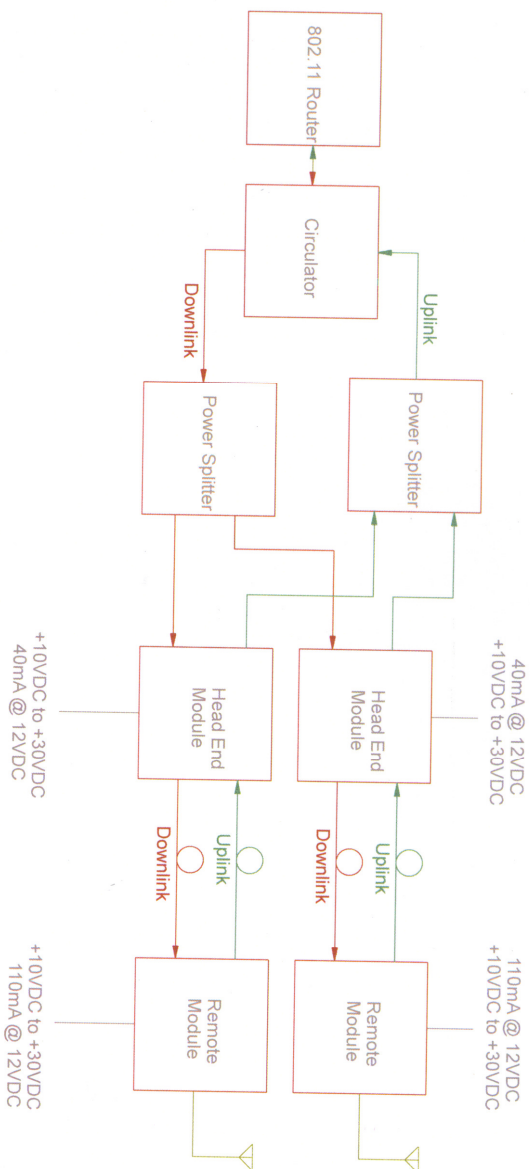
AWICS implements a multiple antenna system such that the transmitter at the existing network connection (LAN/WAN) does not radiate transmitter radio frequency (RF) power. Instead the RF power is spilt into any number of paths converted into light and sent over fiber optic cable to remote units located at optimum user locations, (inside buildings, outside buildings and scattered around the airport grounds). All remote locations convert the light signal back into RF power and radiate RF from many points. This system allows growing the coverage area by adding additional remote units and connecting with additional fiber optic cable. All this without obsolescing your initial investment or diminishing your original coverage.

Installation

Choose a proper site: The AWICS system may be installed either indoors or outdoors. Considerations about antenna placement, power input availability and relay connection requirements should be taken into consideration when selecting a suitable installation location. Use Figure 4 to help you install the system components you selected for your system.

Test the system after installation to ensure maximum range is met.

Mentor Radio Two Endpoint AWICS Diagram



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AWICS Simple Block Diagram

TITLE: Basic_Connection_Block_Diag

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Solutions for Advancing Communications

Testing



Maintenance

No routine maintenance is necessary, other than to remove accumulated dust. If the equipment is accidentally impacted or dropped, operation should be fully checked and an internal inspection made for loose or broken parts.

Optional Accessories

Mentor Radio offers a wide assortment of accessories to provide a complete installation solution.

[Splitters](#) and [Circulators](#) are available for connecting the base unit to your existing network. Coax cables to connect router/access points to base units/splitters and circulators. Wi-Fi [antennas](#).

Solar Panels for making remote units self powered to minimize installation expense. Available in several sizes and power ranges to provide optimum choice between cost and utilization.

Batteries are available in several sizes to allow for a wide range of expected weather conditions where there is insufficient daylight to charge the battery.

For remote installations there are two power options available.

- For indoor use, use [AWICS-BU](#) to operate from 12VDC power and [AWICS-BU-XF](#) for 115VAC.
- Outdoor use, use part number AWICS-RUO to operate from DC or Solar (with battery backup) or part number AWICS-RUO-XF to operate from 115VAC.
- Solar panel should be selected based upon geographic location. (NOTE: Amount of power produced by solar panels is dependent upon many variables. Geographic location of installation, orientation of panel installation relative to surroundings and other factors can have a significant impact upon power realized from any solar powered installation.)

Troubleshooting

Servicing and Repair

Should the system require servicing, return it to us with a description of the problem. ***SERVICE SHOULD ONLY BE ATTEMPTED BY TECHNICIANS EXPERIENCED WITH THIS TYPE OF EQUIPMENT AND WHO HAVE AVAILABLE THE APPROPRIATE TEST EQUIPMENT. CALL OUR OFFICE FOR SERVICE.***

LIMITED WARRANTY



Your Mentor Radio equipment is warranted to the original consumer purchaser only, for one full year, to be free from defects in materials and workmanship under normal use. This warranty does not include damage to the product resulting from accident or misuse.

If the equipment should become defective within the warranty period, we will elect to repair or replace it, without charge, if returned, postage prepaid, to the address shown below. We are not liable for defects or damages caused by the use of unauthorized replacement parts and/or service.

ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO ONE YEAR.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

MENTOR RADIO, LLC, BECAUSE OF LACK OF CONTROL OVER THE CONDITIONS OF USE OF THIS EQUIPMENT, IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. ANY RECOVERY MAY NOT BE GREATER THAN THE PURCHASE PRICE PAID FOR THE EQUIPMENT.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.