

Radiarc® Technologies, L.L.C.



Remote Mechanical Azimuth
Steering & Tilt Antenna
Positioning Mounts

Background

The worldwide explosion of mobile phones and other wireless devices for both personal and business use has created a daunting challenge for Carriers to provide dependable bandwidth for their customer's everyday use. **THE NEED TO KEEP NETWORKS OPTIMIZED HAS NEVER BEEN MORE CRITICAL!**

To assist Carriers in managing this multifaceted problem NOW, Radiarc® Technologies has developed its Game Changer® and Pathfinder® series of AISG compliant, remote, mechanical azimuth steering (bearing), up and down-tilt antenna positioning mounts. These patented series of remote-controlled antenna mounts are engineered specifically for the telecommunication industry to substantially enhance the functionality of existing antennas (with or without Remote Electrical Tilt devices) and provide the ability to remotely adjust the physical orientation of the antenna (to a much greater degree than RETs) at any time. *Though designed to be 'plug and play' in series in an AISG environment, the Site Saver® model is currently in use in non-AISG environments using IP and AT commands.*

Currently, there is a frantic race to incorporate artificial intelligence (AI), and integrated radio heads into the next generation of antennas. The Radiarc® Coverage King® and Site Saver® models are exceptional tools to help self-optimizing networks (SONs) respond to AI predicted anomalies, optimize and reconfigure networks to ensure that end-users enjoy stable performance.

Conventional Antenna Mounting

The antenna is installed onto the structure using a bracket system most often provided by the antenna supplier. **Figure 1** depicts a typical two-point bracket system. The bottom bracket provides a horizontal pivot point for the antenna while the top bracket enables the antenna to be manually tilted to the appropriate tilt setting identified in the RF site design and then secured into place.

The azimuth position of the antenna is determined simply by fixing the rotational position of the mount on the mounting mast. Once the antenna is installed and mounted, the physical orientation of the antenna cannot be changed or adjusted unless a service technician manually makes an adjustment. However, the RF down-tilt coverage can be adjusted to a very limited degree using the antenna Remote Electrical Tilt (RET) system (if so equipped) as seen in **Figure 4**.

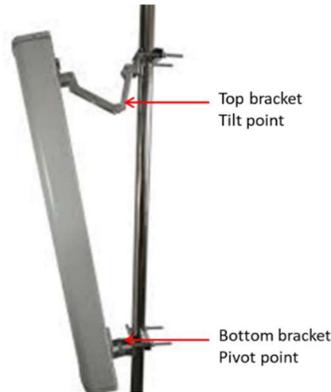


Figure 1: Common cellular antenna mechanical bracket system in use today

Cellular Site RF Coverage Management

Until now, cellular site RF coverage management often required the use of both mechanical and remote electrical tilt methods to optimize RF coverage. The mechanical tilt system is a manual system that requires technical personnel to physically access the antenna's brackets to tilt the antenna to a pre-determined angle. The mechanical tilt changes the RF coverage by tilting the antenna below its horizontal axis. Though mechanical tilt changes the cellular site RF coverage, it does not affect the phase of the RF input of the antenna. **Figure 2** depicts the results of mechanically tilting the antenna and the associated RF coverage.

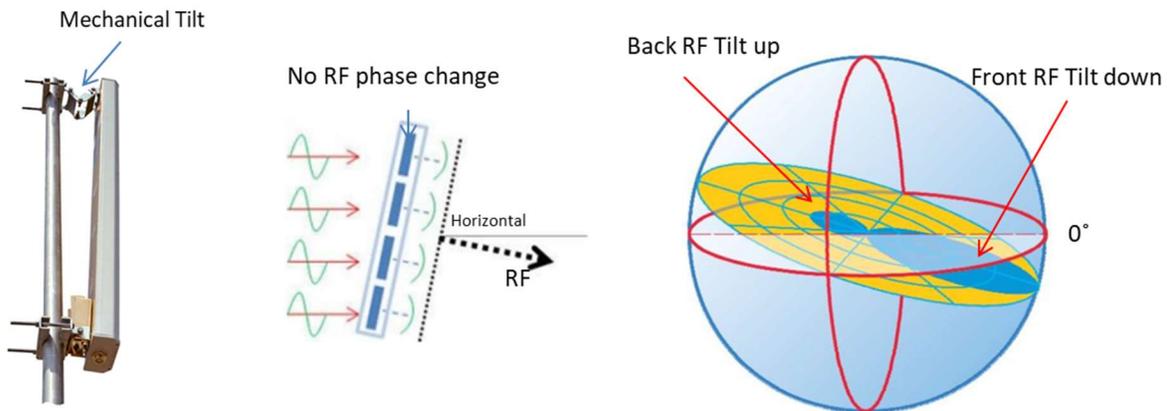


Figure 2: Mechanical Tilt RF coverage

Mechanical tilt alters the position of the antenna and its associated RF coverage. In

Figure 2, the antenna RF tilt is only one plane, the RF FRONT part is tilted down to decrease the gain on horizon while the RF BACK side is tilted up.

Figure 3: Mechanical tilt RF radiation coverage

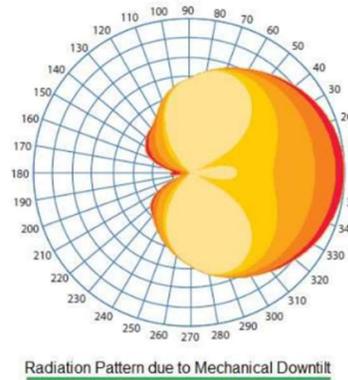


Figure 3 depicts the mechanical tilt which results in the RF pattern bloom causing the RF coverage in the central direction to decrease while the RF coverage for in the side directions are increased.

The antenna Remote Electrical Tilt (RET) system is a system that enables operators to remotely change the antenna’s tilt by a few degrees. **Figure 4** depicts a typical antenna’s Remote Electrical Tilt system which consists of one or more rods or series of bolts that can be adjusted either manually or remotely, using one or more integrated motor(s) to move the antenna’s RF phase shifter and an electronic control board to manage the communication and the integrated tilt system.

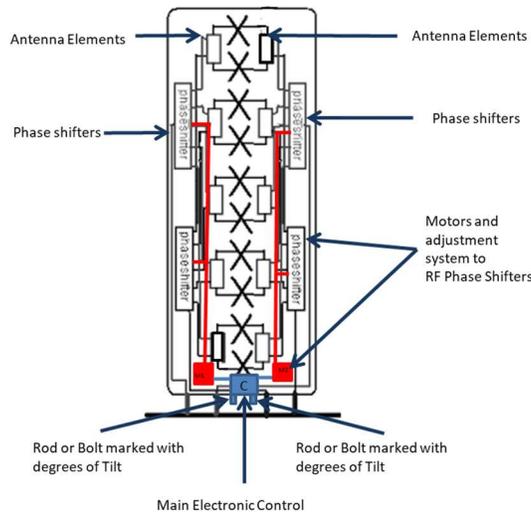


Figure 4: Antenna Remote Electrical Tilt system

The Remote Electrical Tilt provides a certain amount of control and flexibility in shaping the antenna RF radiation. Using an antenna phase shifter, the Electrical Tilt system changes the phase element of the antenna's radiating elements separately and simultaneously. The Electrical Tilt system changes the gain of the RF pattern around the full 360° of the antenna. The antenna FRONT and BACK radiation move in the same direction.

Figure 5 provides an example of the electrical tilt results to the phase shifting of the antenna radiation.

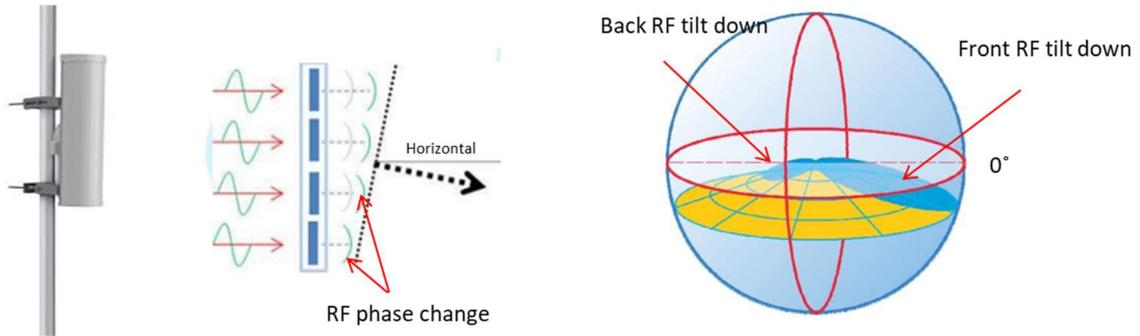


Figure 5: Electrical Tilt RF coverage

Figure 6 depicts the electrical tilt affect to the antenna's elements and the associated RF coverage results. The electrical tilt results in a uniform RF coverage in the direction of the antenna's azimuth. The results are achieved by the electrical tilt system changing each individual radiating element of the antenna array where the RF pattern is evenly distributed.

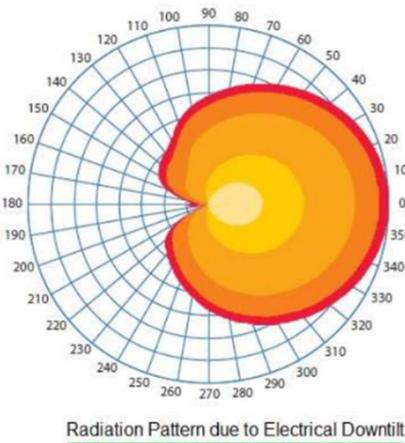


Figure 6: Electrical tilt RF radiation coverage

Adding a new cellular site or new antennas to a Carriers' network is very costly and requires precise engineering and network-wide optimization. Establishing a new

cellular site or adding antennas to an existing site often requires adjustments to neighboring cellular sites. Cellular operators incur great expense when changing site equipment and sending personnel to install or adjust it. Though electrical tilt and radio reconfiguration can be done remotely, mechanical tilt and azimuth adjustments require technical personnel to climb the structure to access the mechanical mounting system. The expense for a tower crew to perform those adjustments can range from \$2,000 to \$3,000 in addition to other related expenses. The additional expenses are often associated with installation equipment and personnel such as a bucket truck, manlift, crane (or in extreme cases even a helicopter), law enforcement personnel to control traffic and road access, to provide security / escort personnel for access to secured areas such as roofs and water tanks, hospital, and school campuses.

Product Offering

Now You Can.....

- Easily **integrate** into your existing **Self-Optimization System**
- **Manage & Control** coverage using **proven (AISG) Standards**
- **Optimize** your network **remotely, whenever** desired
- Improve** your network **performance** and reliability
- Reduce** operating and maintenance **costs**
- Respond in **real-time** to network traffic **changes** and errors
- All without having to send teams to climb the tower!

Radiarc® Technologies Game Changer® and Pathfinder® series of antenna mounts feature the Coverage King®, Site Saver® and Marksman® models specifically designed to be AISG compatible for the Telecommunications Industry. The Pathfinder® series, featuring the Marksman® is specifically designed to reposition microwave dishes.

The Game Changer® series of AISG compatible, in-line, remotely actuated antenna mounts allow you to:

- Make unlimited azimuth and down-tilt adjustments remotely from the NOC or on-site **WITHOUT HAVING TO CLIMB!**
- Motor control modules operate within the existing installed AISG 2.0 power & control infrastructure environment and are being written in to AISG 3.0
- Serial daisy chain connection to AISG RET control units
- Physically adjust the position of the antenna where you want when you want

Summary

Radiarc® Coverage King® is a remotely controllable, AISG standard compatible, antenna mounting system which provides both mechanical azimuth (bearing) steering and mechanical down-tilt adjustments in-line with (or without) the mounted antenna's existing internal Electrical Down-tilt functionality. The FFAZD2 Coverage King® uses AISG compatible motor control units and AISG Standard compatible control and monitoring systems to make adjustments to the physical orientation of the antenna in addition to any internal electrical down-tilt functionality.

An AISG azimuth (bearing) control unit drives the horizontal movement of the antenna through a -60° to $+60^\circ$ range of azimuth angle positions in increments of $1/10^{\text{th}}$ of one degree at a time! A second AISG control unit provides an independent 20° range of mechanical down-tilt positions. If down-tilt capabilities are not required, the Radiarc® HZAZ2 Site Saver® provides the same horizontal functionality as the Coverage King®, without mechanical down-tilt capabilities. Up-tilt functionality, as well as additional range of azimuth (bearing) and down-tilt motion is available by special order; call for details.

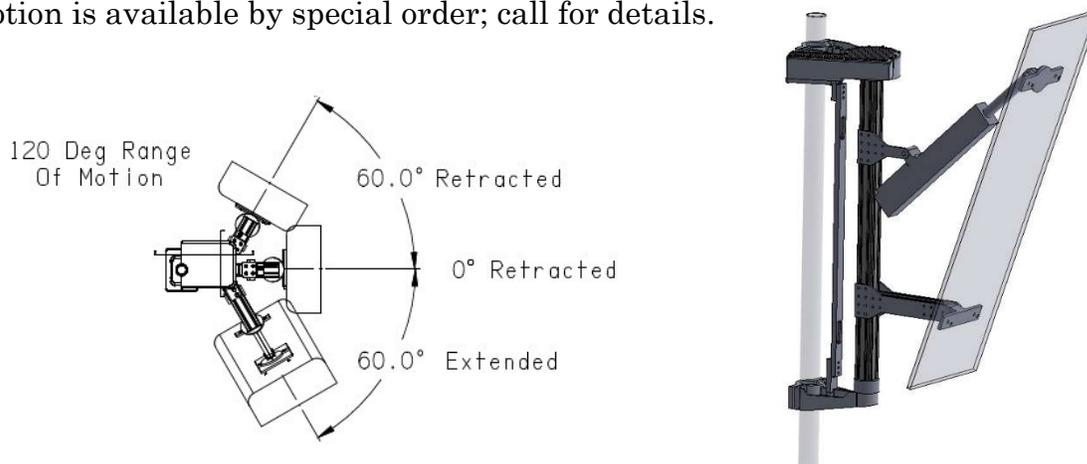


Figure 7: Radiarc® Coverage King® & Site Saver® azimuth (bearing) standard range of motion

Radiarc's proprietary AISG controlled antenna mounting systems provide the network operator the ability to adjust both the physical orientation of the mounted antenna along with the electrical down-tilt for ultimate coverage and optimization, literally by **aiming the antenna where and when the coverage is desired.**

Radiarc® Game Changer® series of antenna mounts compliment any on-board Electrical Down-tilt for ultimate RF coverage optimization and adaptability to network changes: standard physical azimuth (bearing) rotation of 120° from -60° to $+60^\circ$, with 160° from -80° to $+80^\circ$ available via special order. Physical down-tilt from 0° to $+20^\circ$ is provided standard with more available via special order. The Radiarc® Pathfinder® series of mounts are specially designed to position microwave dishes.

The Marksman® is the flagship of the Pathfinder® series of microwave antenna mounts, moving from 25° to -25° azimuth/bearing (with much more available via special order), 10° up-tilt & 10° down-tilt, **ALL IN 1/10th OF 1° INCREMENTS!**

Technical Specifications

Game Changer® Series Telecom Mount Specifications

Model: FFAZDT2 Coverage King® has both azimuth (bearing) & down-tilt functions

Model: HZAZ2 Site Saver® has azimuth (bearing) capabilities only, no down-tilt

Pathfinder® Series Microwave Dish Mount Specifications

Model: MWUTDTAZ1 Marksman® has azimuth steering (bearing), as well as up-tilt **AND** down-tilt functionality

CERTIFICATIONS

EC60068-2-6:2007 & EC60068 Part 3-3	FCC Part 15 B Class A
IEC EX61000-4-5 Surge Immunity Test	CISPR EN55035:2017
Wind 241 km/h / 150 MPH	IP66 Certified

MECHANICAL SPECIFICATIONS

Length & Depth	38" x 18" (customizable to specific antenna models)
Net Weight	45 lbs. Coverage King® 35 lbs. for Site Saver® model 30 lbs. for Marksman® model
Temperature Range	-40° to +140°
Wind Speed	241 km/h / 150 mph (gusts & sustained)
Azimuth Range	-60° to +60° (-80° to +80° available via custom order)
Down-tilt Range	Coverage King® 0° to +20° degrees (more available) Marksman® 0 to +10 degrees
Up-tilt	Marksman® 0 to -10 degrees
Gear Reduction	50-1 Worm gear (proprietary, ultra-low backlash)

ELECTRICAL SPECIFICATIONS

C-485 AISG Connector

AISG C-485

Pin Configuration

Pin 1	10 – 15 Vdc	Pin 2	No connection
Pin 3	RS485B	Pin 4	No connection
Pin 5	RS485A	Pin 6	19 – 30 Vdc
Pin 7	DC return	Pin 8	No connection

Voltage Requirements

10Vdc to 15Vdc on Pin 1

15Vdc to 30Vdc on Pin 6

Current Consumption @ 24Vdc

Quiescent	~25mA
Operating Current	~140mA
Startup Current	~400mA



© 2020 Radiarc® Technologies, L.L.C. All rights reserved. Radiarc®, Game Changer®, Coverage King® and Site Saver®, Pathfinder® and Marksman® are registered trademarks of Radiarc® Technologies, L.L.C. Patented: US 10,511,090 B2, US 10,944,169 B2, US 11,005,177 B2, with other US & International patents pending. All Specifications subject to change without notice.