



proposal

Dinwiddie and Amelia Counties
Joint Broadband Project



Prepared For: Dinwiddie and Amelia Counties
Virginia

Prepared By:



VIRGINIA AIR NETWORKS

DINWIDDIE AND AMELIA COUNTIES

Joint Broadband Project

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OFFEROR INFORMATION

1.1 Point of Contact

Name: Joseph Jones
Title: Vice President/COO
Address: 101 Founders Way, Suite C
Strasburg, VA 22657
Office Tel: (540) 328-9876
Mobile: (540) 664-0119
Email: jjones@vaairnet.com

1.2 Company and Project Information

Virginia Air Networks is a Virginia based company registered with the SCC as an LLC (Limited Liability Corporation) with 2 officers sharing 50% each of the company respectively. Joe Jones is the head project manager and practices a matrix organizational structure in regard to projects the company is involved in, this is practiced as it is found to help members respond to changes in the project faster and more efficiently. The company is broken in to 3 divisions, and each team has a functional manager that reports to the project manager or executive team.

- **Essential Office Staff:** These staff members are responsible for maintaining the daily operations throughout the company. Ensuring team members from other divisions have the necessary information and equipment to perform their daily tasks in timely manner and on budget. These members also are responsible for being the front line with customers from initial contact to final installation.
- **Field Staff:** Field staff are multi-faceted in the company. Field staff can range from installers to certified on staff tower climbers. This team is responsible for tower maintenance, tower builds, customer installs, and will assist the IT staff with equipment troubleshooting in the event of an issue.
- **IT Staff-**Staff members in this division ensure the network infrastructure is in working order and running at optimal performance. Member under this division are also responsible for assisting customers with issue if/as they arise. The IT staff also works hand in hand with the field team during our projects to plan and execute new equipment at tower locations.
- The company's executive team assists all teams in their areas. Executive team members can be found in the field during tower builds or maintenance or in the data room helping out the IT staff. Essentially providing help in an area needed, while also ensuring the daily operations and growth of the company are continually within the company's standards.

Members from all teams are required to work hand in hand to ensure this and all projects are on schedule and on budget with the guidelines implemented by the project manager.

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1.3 Experience

Virginia Air Networks was founded by Darin Hockman and Joe Jones in early 2017. Both member of the executive team has ran separate companies for a combined term of 30+ years. Mr. Jones (project manager for the project) has been in the IT industry for 19 years and has built and maintained many different types of networks, from simple home networks, to large scale enterprise networks. The company has 4 certified tower climbers and builders on staff, eliminating the need for subcontractors to work on vertical assets. The company has also worked to become AVETA accredited (a requirement to climb SBA towers) and has also worked with most major tower management companies and has passed the requirements set forth to become certified to climb towers managed by these companies. VA Air has also been requested to manage an existing tower located at the Middletown Data Center in Middletown VA. The company also employs an in-house engineer to assist with projects in the beginning phase to ensure wind loads are not exceeded and towers will remain structurally sound during the collocation, equipment installation or tower erection stage. VA Air uses outside consultants occasionally for network or tower design. Recently jumping in to the fold to assist with a major network overhaul was Skynet in Bozeman, MT. The consultants at Skynet have helped design a network that will be built simultaneously beside the existing network and will allow for little to no downtime to the client as a result. Upon completion of this upgrade, VA Air will roll their next generation of plans out that will be capable speeds in excess of 300Mbps Download and 100Mbps Upload per customer.

Recent projects completed by the staff members include a 5 square mile hotspot project, allowing for visitors at the facility to have free internet for browsing and live streaming of events. This entire project was handled and completed by the IT staff. The field team in the past 9 months have erected towers ranging in size 60' to 200'. These towers were of various types from guyed to self-supporting structures. In addition, the teams have brought over 150 new customers on to our service since January of 2019.

1.4 Subcontractors/Consultants

VA Air Networks may consultant with the following during the life of this project

- SkyNet
Chris Johnson (Owner)
Bozeman, MT.
Phone: (406) 580-7010
Email: cjohnson@getskynet.com

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1.5 Financial Statements

Financial statements can be furnished upon request.

1.6 Attestation

- No principal or staff member is obligated to disqualify themselves from participation in this project based on any transaction arising from or in connection to the Virginia State and Local Government Conflict of Interest Act.
- No members of the company or partners are currently disbarred or suspended by any federal, state, or local government entity. The principals have not operated any entity that is disbarred or suspended.

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COST OF SERVICES FOR USER

2.1 Contract Terms

Virginia Air Networks does not hold subscribers to any contract terms. Virginia Air Networks operates on a month to month basis for all commercial and residential subscribers.

2.2 Service Rates

Virginia Air Networks will offer the following rates to all subscribers residential and commercial. Rate plans do not vary based on the type of subscriber.

- 50Mbps/10Mbps \$95.00
- 100Mbps/20Mbps \$125.00
- 150Mbps/30Mbps \$145.00

2.3 Cost of Subscriber Equipment

Virginia Air Networks' formula for ROI of subscriber's equipment is factored in to the cost of our rate plans. By month 2 of the subscriber's term, the company will begin to profit from the subscription. Therefore, in order to keep the cost low for the subscriber the company does not force the subscriber to incur any up-front cost for a basic installation*. Any special equipment, necessary modifications to receive service, or modifications to the property out of the scope of a basic installation will be considered a custom installation** and shall be negotiated with the subscriber. The company will provide a written estimate to the prospect and will then be the responsibility of the prospect to determine if they wish to incur the additional fee in order for the company to provide service.

2.4 On-Site Installation Fees

Virginia Air Networks does not charge a fee for a basic installation. Any special equipment, necessary modifications to receive service, or modifications to the property out of the scope of a basic installation will be considered a custom installation and shall be negotiated with the subscriber. The company will provide a written estimate to the prospect and will then be the responsibility of the prospect to determine if they wish to incur the additional fee in order for the company to provide service.

2.5 Additional Fees

Virginia Air Networks charges a \$25 activation fee upon installation. However, there are no additional fees associated with service installation, unless noted as a custom installation.

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2.6 Payment Terms

Payment for services are due on the 1st day of the month. A prorated charge is assessed prior to the first billing cycle for days prior to the 1st billing cycle due. In the event of failure to provide payment on the 1st, the subscriber has until the 6th to provide payment. If payment is not provided at that time service will be disconnected until payment is provided. The subscriber must provide payment with 5 business days of service disconnection due to non-payment or a \$25 reactivation fee will be assessed in addition to the previous balance due. After 30 days of non-payment the account will be considered inactive and is now subject to be considered as default and is subject to fees for equipment not returned in addition to fees previously due.

2.7 Cancellation Fees

In the event a subscriber terminates service no additional fees will be collected. Once service has been terminated the subscriber will be required to allow the field team to collect equipment used for installation (minus cabling, hardware used for installation, or subscriber outright purchased equipment) within 30 days or the subscriber will be charged to price of the equipment at full MSRP.

2.8 Discounts

Virginia Air Networks offers discounts for first responders. In addition, the company also provides free internet to fire and rescue facilities.

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DINWIDDIE COUNTY CONCEPTUAL DESIGN

3.1 Overview

When evaluating the area of Dinwiddie and Amelia counties, longevity and budget consciousness was taken in to consideration. Multiple options can be used to achieve 95% connectivity throughout both counties. In this section we will break down the most cost-effective option for this project. We will evaluate using strictly assets that are currently in place and the possibility any additional assets needed to complete the project (i.e. donated towers). We will use the tower at 14230 Sycamore Dr. in Dinwiddie as our starting point of the spoke-hub distribution design.

When approaching this project research went in to the area regarding available tower spaces on existing vertical assets, in addition to other resources available in the area. As the Sycamore Dr. tower is a county owned property, it is the most favorable for this network design. After determining this to be the starting point of the project, MBC was then contacted to verify fiber is available at this location for backhaul installation. With this tower as the central hub, the expandability to most towers available in the county was now a reality. This one brings all traffic back to a central location. This site would be the start and end of the network. Included are drawings/mappings of this concept. An explanation will be given in regard to each attached drawing.

- Image 1.1 will show the Sycamore Dr. tower with 11Ghz licensed links with a clear line of sight to each tower. This will help show the spoke-hub distribution for this project. Due to weight and wind load limits. Towers inside the spoke and hub design can also repeat on to another sister tower required to bring coverage into areas lacking service. In image 1.1 the Sycamore Dr. tower is accessible to all towers pictured. This may deviate strictly for backhaul locations as they may be collocated on one tower to another.
- A structure such as a telco building will be placed on the property to house the network as well as provide security for the network and equipment. Safety devices including a fence surrounding the structure and security cameras with alarms to notify the company of any events occurring around the structure. A generator will also be factored in to this site for power redundancy. A 30 square foot plot will need to be used for the building and generator, as well as electric utility meter for service. Image 1.2 will show an example of the telco structure proposed for this site.
- The tower should have a structural analysis and should be repaired prior to collocation. We have repaired issues with towers and will be available to repair this tower if deemed repairable free of charge.
- MBC was contacted to verify that a fiber backbone is available at this tower site. They have confirmed that fiber is available. MBC has stated they are a fiber transport and a cross connect to a provider is needed. Upon conversations with MBC, VA Air Networks currently has a working relationship with a carrier in the datacenter MBC has presence in currently.
- MBC has stated that several towers in play for this project currently have fiber to the tower. VA Air Networks will utilize this and bring multiple feeds in for redundancy as well load balancing.
- 11Ghz licensed radios will be used to transport connectivity to each tower in the proposed plan. These links will be coordinated through Intellipath.
- Each tower will house 5Ghz antennas, generating 360-degree coverage. A 5Ghz coverage map is provided in attachment 1.3.

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- To expand in to areas where coverage is not available to all by LOS to the tower, a MicroPoP can be put in place. A MicroPoP can then distribute using 60Ghz shortwave frequencies to potential subscribers. MicroPoP's can vary as to how they are constructed. They can be a simple tripod on a subscriber's home to collocating on a utility pole.
- Due to the speeds being proposed a 4-mile radius is being used from each tower sight. In our findings, a subscriber can go from a longer distance to achieve service. However, this does increase radio transmit times which essentially will affect other subscribers throughout the network. Our best practices allow for little deviation from this plan.
- 3 separate towers should be constructed in the onset of the project. This will help to achieve the 95% coverage required for this project. These were stated as future sites for Verizon towers according to attachment in the RFP. A third tower may be required prior to tower completion. These towers are the following:
 - 21002 Walkers Pond Road, Sutherland Monopole 37-12-13.8N 077-32-40.7W
 - Flat Foot Road, Dinwiddie, Monopole, 37-00-47.3N 077-30-14.7W
 - Glebe Road, Dewitt, VA Monopole 37-04-42.5N 077-41-35.1W

Attachment 1.4 displays these proposed towers and the coverage they will provide in a 4-mile radius

- Attachment 1.5 provides a list of equipment to be utilized at each tower. Cost analysis will be provided in the budgetary worksheet.
- The core network equipment is listed in attachment 1.6
- In the final attachment 1.7 a full coverage using all proposed resources and the coverage they provide; these sites could vary as there are several sites close to the proposed tower.

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AMELIA COUNTY CONCEPTUAL DESIGN

4.1 Overview

With the lack of infrastructure in Amelia county, a starting point for the spoke and hub design is more difficult to replicate. With that, the plan is to initially start in Dinwiddie county and broad cast in to Amelia. However, if a colocation site can be identified a separate spoke in hub design can be drawn out and implemented. Due to the lack of this during the writing of this proposal, we have determined to move forward with the first design coming from Dinwiddie. However, we are currently still evaluating sites that may have the proper infrastructure in place to deviate from this plan. The plan is still valid regardless due to the initial hub would be the only spot moving if a backhaul site supporting fiber installation is identified.

- Due to the lack of true incoming fiber to the sites in Amelia county, the backhaul will come from the Sycamore Dr. Tower
- Image 2.1 will show the tower at coordinates 37.232008, -77.728983 with 11Ghz licensed links with a clean line of sight to each tower. This will help show the spoke-hub distribution for this project.
- Once in the county. Expansion can happen through the first tower on to towers with LOS via 11 Ghz frequency.
- Towers within Amelia county will be utilized with 5Ghz sectors and designed to broadcast high speed internet 4miles
- The use of MicroPoPs will be more present in Amelia county due to the lack of vertical assets. The 60Ghz spectrum will be utilized in population rich areas, whereas 5Ghz will be used for the less dense areas in order to expand further in to the areas that are under served.
- 11Ghz licensed radios will be used to transport connectivity to each tower in the proposed plan. These links will be coordinated through Intellipath.
- Each tower will house 5Ghz antennas, generating 360-degree coverage. A 5Ghz coverage map is provided in attachment 2.2 with towers that are able to be currently utilized. Full coverage using all proposed resources and the coverage they provide; these sites could vary as there are several sites close to the proposed tower. This is subject to change in the event a backhaul hub can be identified.
- Due to the speeds being proposed a 4-mile radius is being used from each tower sight. In our findings, a subscriber can go from a longer distance to achieve service. However, this does increase radio transmit times which essentially will affect other subscribers throughout the network. Our best practices allow for little deviation from this plan.
- Attachment 1.5 provides a list of equipment to be utilized at each tower. Cost analysis will be provided in the budgetary worksheet.
- During the process of compiling data for this proposal, several sites are being investigated for repeating coverage further. They are identified by the purple drop pin with a purple expected coverage area in attachment 2.2.

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DISCLAIMER

Due to factors beyond the control of the company, several vendors are still in process of estimating cost for this project. A budget sheet will be furnished within 5 days of submission as an addendum.

Any missing information will be submitted as an addendum to this original document with 5 day of submission.

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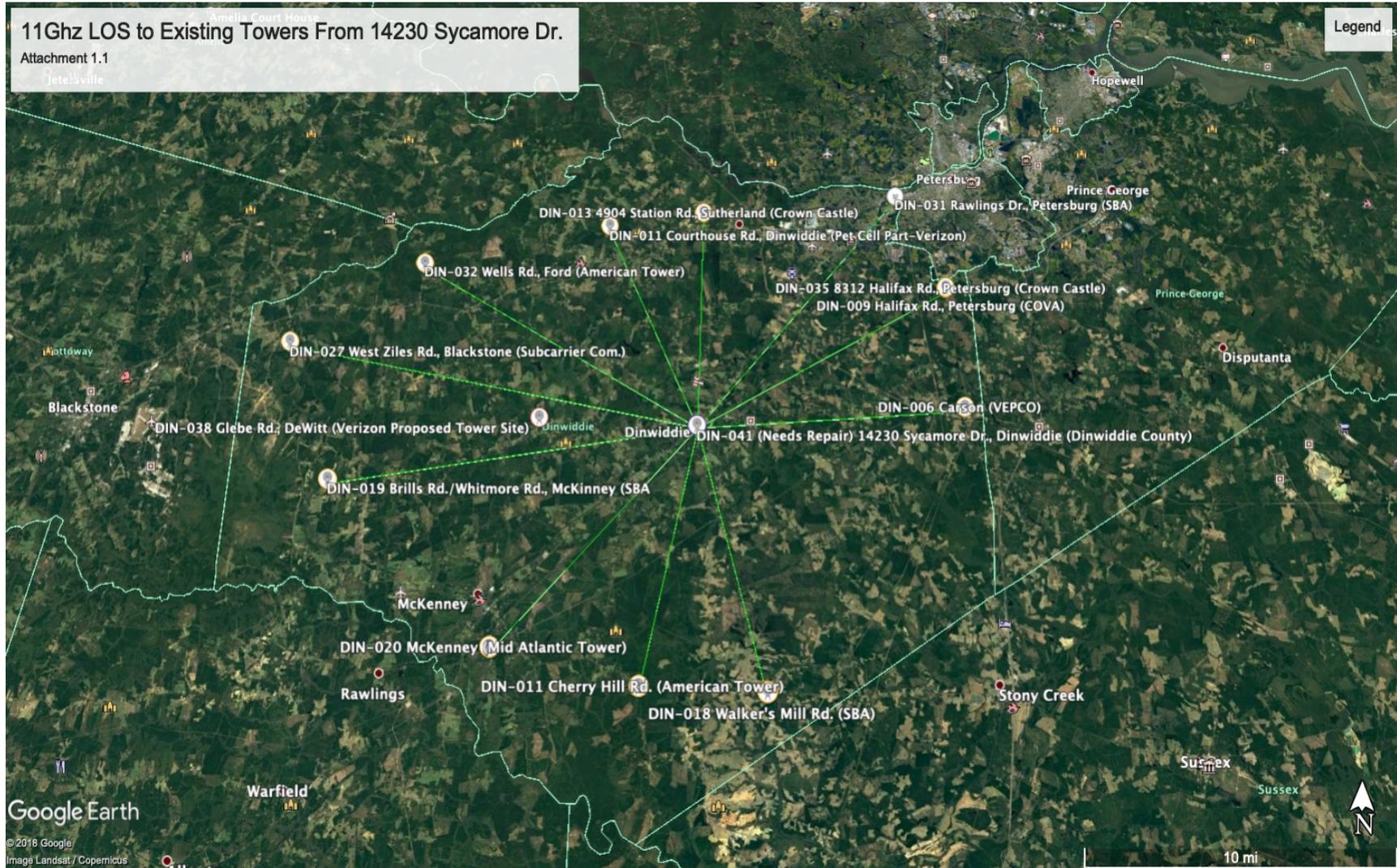
ATTACHMENTS

- 1.1 (Map) 11Ghz LOS Towers from 1420 Sycamore Dr.**
- 1.2 Telecommunications Build Example**
- 1.3 Projected 5Ghz Coverage from Existing Towers**
- 1.4 (Map) Dinwiddie Proposed Tower Sites**
- 1.5 Equipment List**
- 1.6 Core Network Required Equipment**
- 2.1 (Map) Amelia County LOS from Sycamore Dr.**
- 2.2 (Map) Amelia County Existing towers**

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ATTACHMENT 1.2

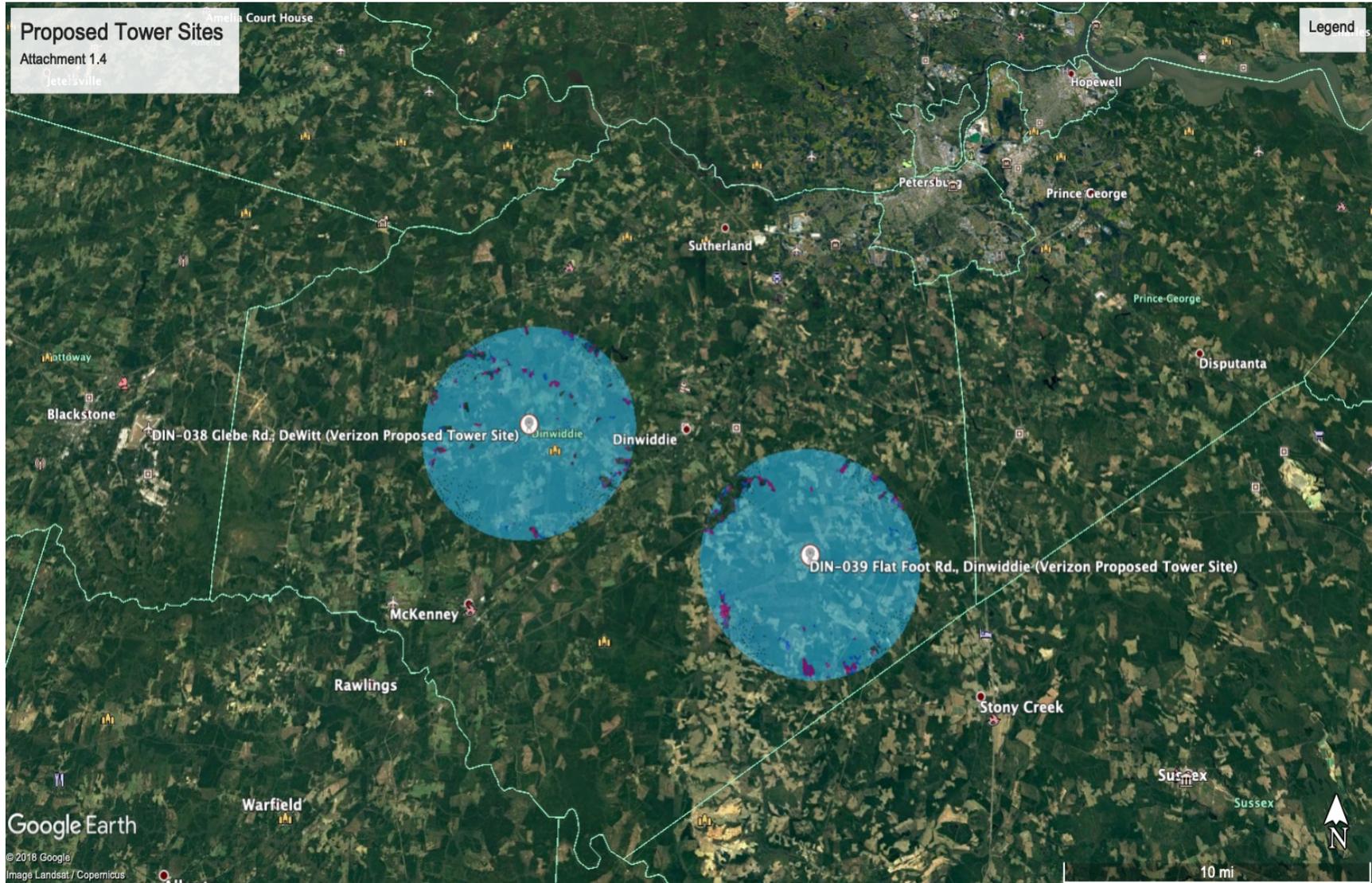


(Example of telecommunications structure with generator)

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ATTACHMENT 1.5

EQUIPMENT TO BE USED

5.1 Network (Tower Equipment)

- Unlicensed Ubiquiti AM-5AC22-45 Sector
- Unlicensed RF Elements HG3-TP-A90 Asymmetrical Horn
- Licensed Ubiquiti airFiber AF-11G3511Ghz

5.2 Customer Premises Equipment

- Unlicensed Ubiquiti PowerBeam 420
- Cambium R190W Router

5.3 Other Equipment (Optional)

- Unlicensed IgniteNet 60Ghz Shortwave Equipment

See pages 20-31 for description and specifications

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ATTACHMENT 1.6

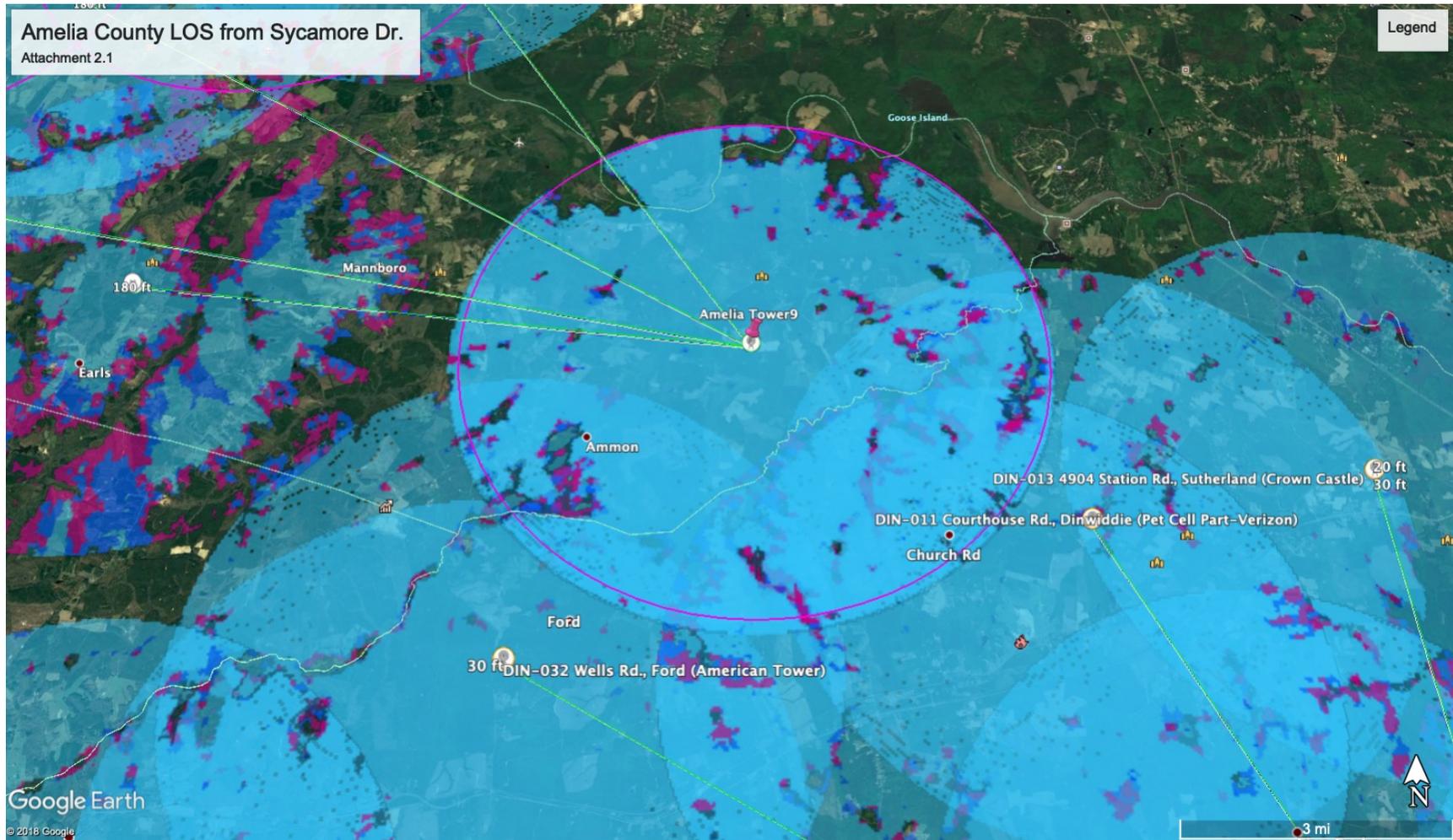
Core Network Required Equipment

Quantity	Description
1	Dell PowerEdge Blade Server System
2	Dell SonicWall Firewall
2	Planet 100GB Switches
2	Mikrotik 4011
1	Network Cabinet
1	GE DC Power Rectifier
1	Tripplite Power Isolator

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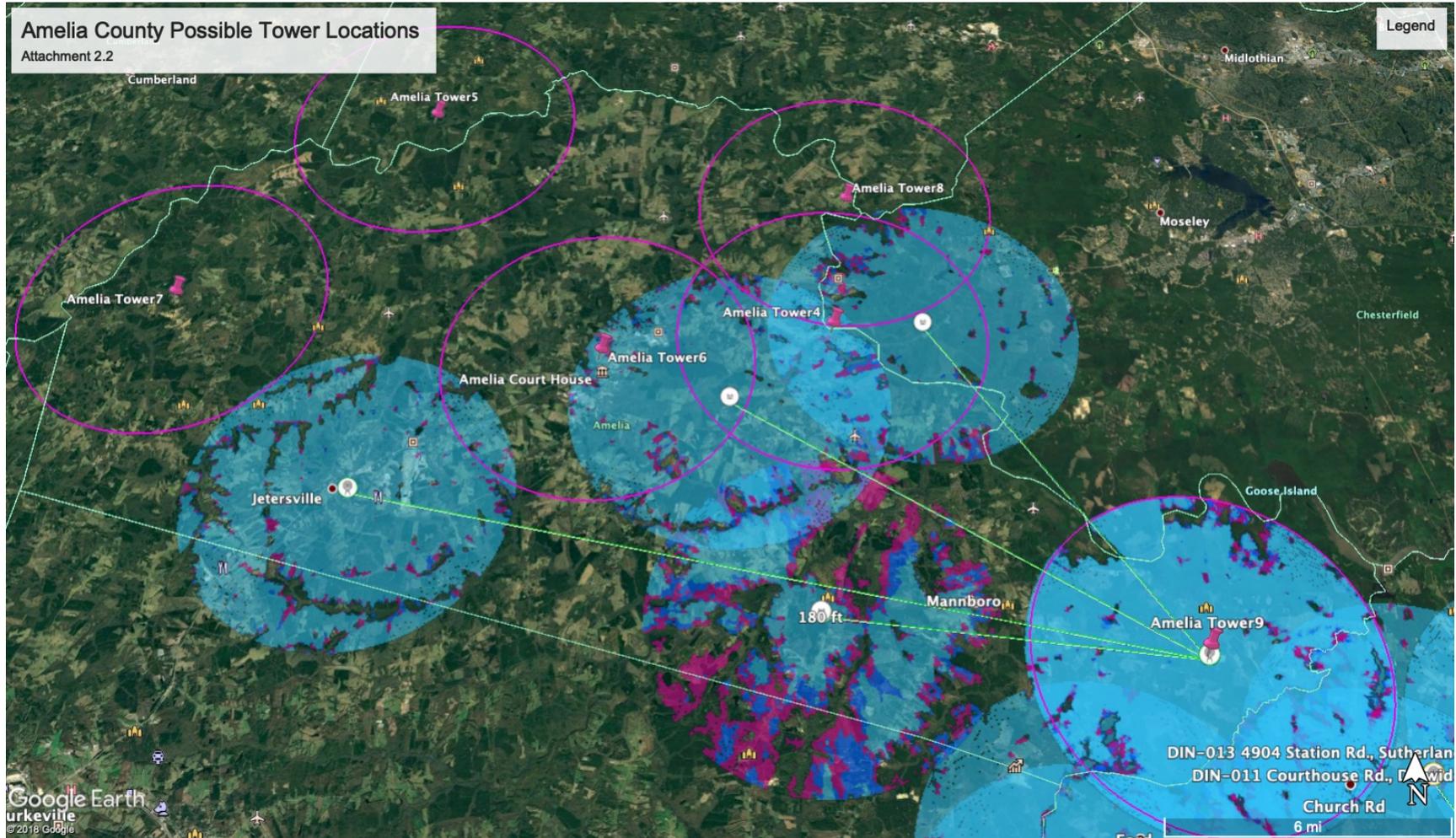
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DATASHEET



airFiber® X Antenna

11 GHz, 35 dBi airFiber® X Antenna
Model: AF-11G35

Powerful Performance for Long-Range Links

Robust Design and Construction for Outdoor Use

Seamless Integration with airFiber AF-11FX Radio



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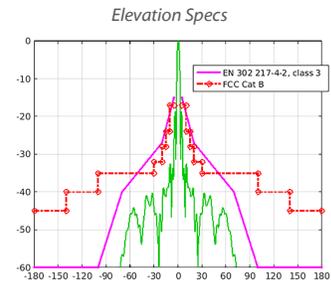
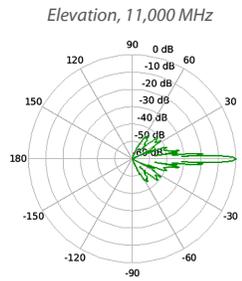
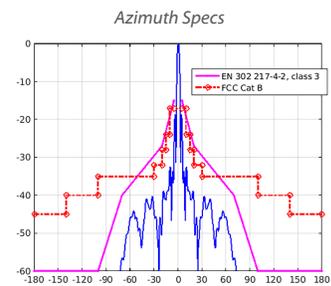
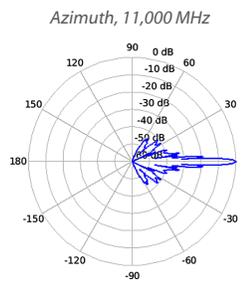
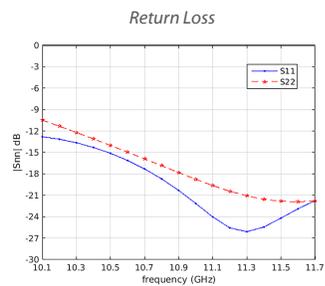
DATASHEET

airFiber X Antenna

Specifications

AF-11G35 Antenna Characteristics	
Dimensions	ø 811 x 460 mm (ø 31.9 x 18.1")
Weight	Mount Not Included : 7.14 kg (15.74 lb) Mount Included : 11.85 kg (26.12 lb)
Frequency Range	10.3 - 11.7 GHz
Gain	35 dBi
HPOL Beamwidth	2.5°
VPOL Beamwidth	2.5°
Front-to-Back Ratio	60 dB
Max. VSWR	2:1
Wind Survivability	200 km/h (125 mph)
Wind Loading	1538 N @ 200 km/h (346 lbf @125 mph)
Polarization	Default: H/V After Rotating OMT: ± 45°
Cross-Pol Isolation	35 dB
Mounting	Uses the AF-5/AF-5U Mounting System
Pattern Regulatory	ETSI 302 217-4-2, Class 3 and FCC Cat B

AF-11G35 Antenna Information



Specifications are subject to change. Ubiquiti products are sold with a limited warranty described at: www.ubnt.com/support/warranty
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airMAX[®] ac Sector

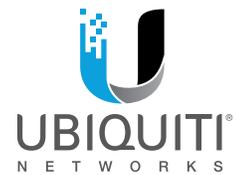
2x2 MIMO BaseStation Sector Antenna

Models: AM-5AC21-60, AM-5AC22-45

Advanced Noise Immunity

Superior Beam Performance

Enhanced Scalability of airMAX[®] Networks



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Datasheet

airMAX ac Sector

Hardware Overview

The airMAX ac Sector Antenna features robust construction for industrial-strength durability during outdoor use.



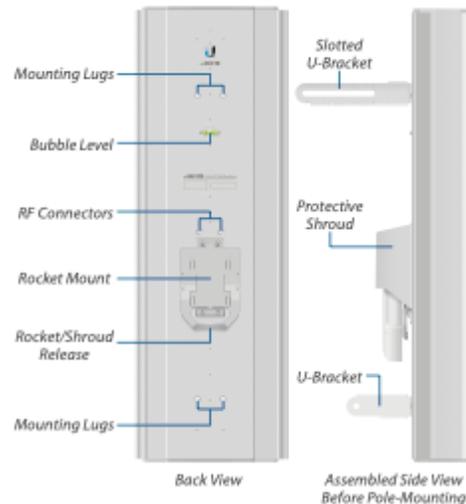
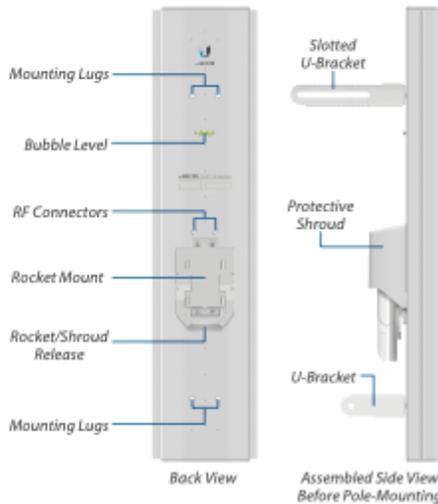
airMAX ac Sector

Model	Frequency	Gain	Beamwidth
AM-5AC21-60	5 GHz	21 dBi	60°



airMAX ac Sector

Model	Frequency	Gain	Beamwidth
AM-5AC22-45	5 GHz	22 dBi	45°



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Datasheet

airMAX ac Sector

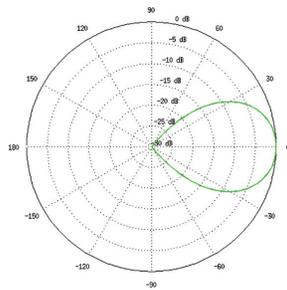
Specifications

AM-5AC22-45 Antenna Characteristics	
Dimensions*	750 x 215 x 94 mm (29.53 x 8.47 x 3.70")
Weight†	6 kg (13.23 lbs)
Frequency Range	5.10 - 5.85 GHz
Gain	22 dBi
HPOL Beamwidth	45° (6 dBi)
VPOL Beamwidth	45° (6 dBi)
Electrical Beamwidth	4°
Electrical Downtilt	2°
Max. VSWR	1.5:1
Wind Survivability	200 km/h (125 mph)
Wind Loading	347 N @ 200 km/h (78 lbf @ 125 mph)
Polarization	Dual-Linear
Cross-Polarization Isolation	30 dB Min.
ETSI Specification	EN 302 326 DN1
Mounting	Universal Pole Mount, Rocket Bracket, and Weatherproof RF Jumpers Included

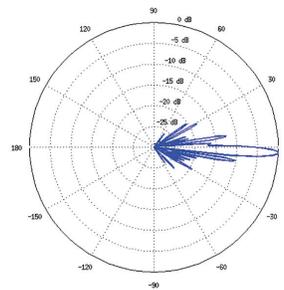
* Dimensions exclude pole mount and Rocket radio (Rocket sold separately)

† Weight includes pole mount and excludes Rocket radio (Rocket sold separately)

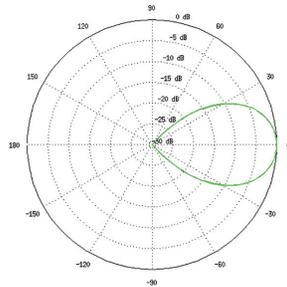
Vertical Azimuth



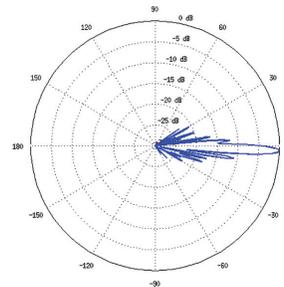
Vertical Elevation



Horizontal Azimuth



Horizontal Elevation



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Product Datasheet
Product ID: HG3-TP-A90



90° Asymmetrical Beam Antenna

HORN ANTENNA WITH TWISTPORT™ CONNECTOR

90° Asymmetrical Horn TP Antenna combines the best of both worlds - high gain of a traditional sector antenna and zero side lobes of a horn. Its radiation pattern is wide in azimuthal and narrow in elevation plane, greatly improving coverage planning options. 90° Asymmetrical Horn TP Antenna exceeds the traditional patch sector antenna thanks to high stability of gain and radiation pattern in the whole band of operation. Outstanding noise rejection and precision of radiation pattern favors 90° Asymmetrical Horn TP antenna for high-density AP clusters, in highly populated areas and dense co-location sites.

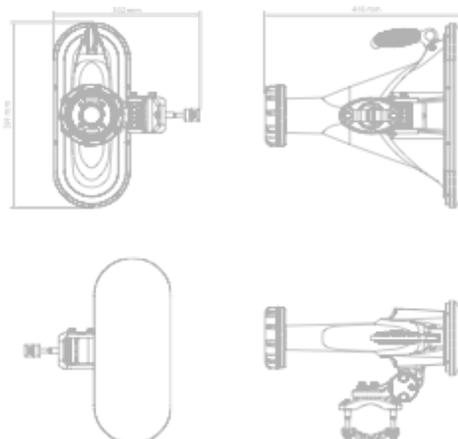
HG3-TP-A90 features our revolutionary TwistPort™ connector- a patent-pending twist-and-lock waveguide port. TwistPort™ is virtually lossless and embodies a complete shift of paradigm in wireless network scalability and convenience of deployment. 90° Asymmetrical Horn TP Antenna supports a wide range of third party mainstream radios with our TPA TwistPort™ Adaptor.



TECHNICAL DATA

Antenna Connection	TwistPort™ - Quick Locking Waveguide Port
Antenna Type	Horn
Materials	UV Resistant ABS Plastic, Polycarbonate, HDPE, Aluminium, Stainless Steel
Environmental	IP55
Pole Mounting Diameter	22-80 mm
Temperature	-35°C to +55°C (-31°F to +131°F)
Wind Survival	160 km/hour
Mechanical Tilt	± 25°
Weight	5.3 Kg / 11.6 lbs - single unit* 7.2 Kg / 15.9 lbs - single unit incl. package*
Single Unit	Retail Box 48.5 x 42.0 x 19.0 cm*

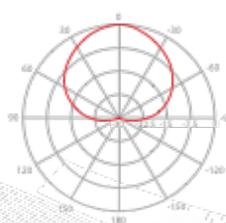
PRODUCT DIMENSIONS



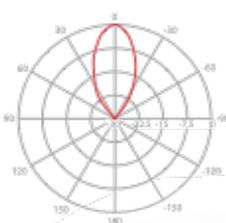
PERFORMANCE

Frequency Range	5180 - 6000 MHz
Gain	16 dBi
Azimuth Beam Width -3 dB	H 60° / V 60°
Elevation Beam Width -3 dB	H 16° / V 16°
Azimuth Beam Width -6 dB	H 90° / V 90°
Elevation Beam Width -6 dB	H 25° / V 25°
Front-to-Back Ratio	30 dB

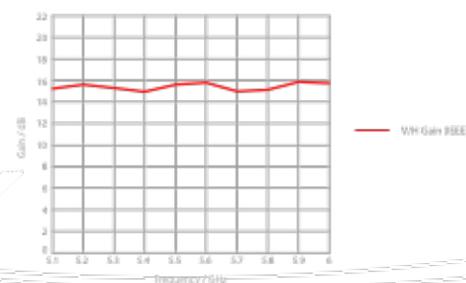
AZIMUTH PATTERN



ELEVATION PATTERN



GAIN



*Subject to change

UP1-201905-TRIAL-9000-9012000-Rev.001-2019

www.rfelements.com

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Product Datasheet

Product ID: TPA-R5AC



TwistPort™ Adaptor for Rocket AC

ADAPTOR FOR ROCKET™ 5AC-LITE

The TwistPort™ Adaptor for Rocket AC makes the Rocket™ 5AC Lite compatible with all TwistPort™ Antennas. TwistPort™ Adaptors have our proprietary quick-locking waveguide connector, enabling simple connection and detachment of Rocket™ 5AC-Lite without any tools.

TPA-R5AC features upgrades in the form of improved feed elements.



TECHNICAL DATA

Antenna Connection	TwistPort™ - Quick Locking Waveguide Port
Radio Connection	2x Slide-On RP-SMA
Materials	Insert - Aluminium Alloy Adaptor - UV stabilized and weather resistant ABS plastic
Flame Rating	UL 94 HB
Temperature	-40°C to +60°C (-40°F to +140°F)
Wind Survival	160 km/h
Weight	0.4 Kg / 0.9 lbs – single unit 0.5 Kg / 1.1 lbs – single unit incl. package 11.5 Kg / 25 lbs – carton (20 units)
Single Unit	Retail Box: 13.5 × 13.0 × 11.5 cm
20 Units	Carton Box: 60.5 × 29.0 × 28.5 cm

PERFORMANCE

Frequency Range	5180 - 6400 MHz
Polarization	Dual Linear H + V
VSWR Max	1.8
Impedance	50 Ohm

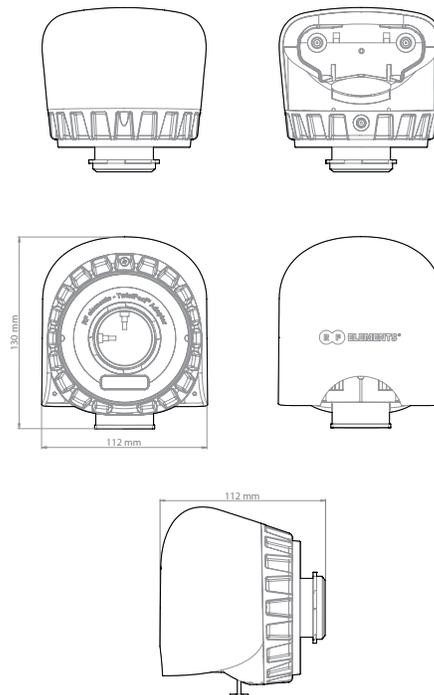
COMPATIBLE WIRELESS PLATFORMS

RF elements*	any TwistPort™ Antenna
Ubiquiti Networks*	Rocket™ 5AC-Lite

PACKAGE CONTENTS

TwistPort™ Adaptor

PRODUCT DIMENSIONS



TwistPort™ Adaptor Rev NOV-2018

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DATASHEET



PowerBeam® AC GEN2

5 GHz High Performance airMAX® ac Bridge

Models: PBE-5AC-Gen2, PBE-5AC-ISO-Gen2

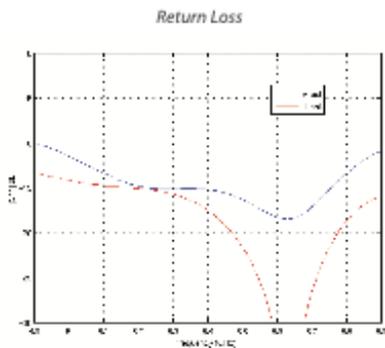
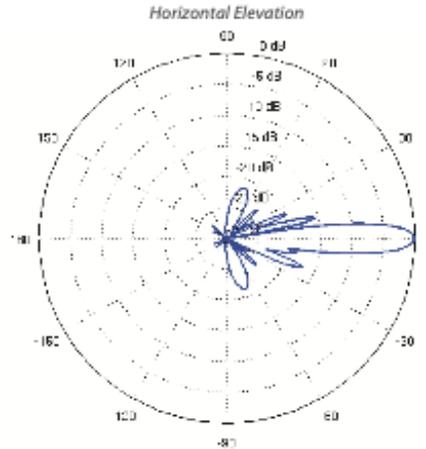
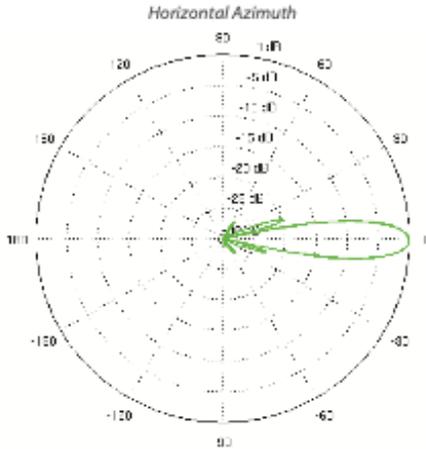
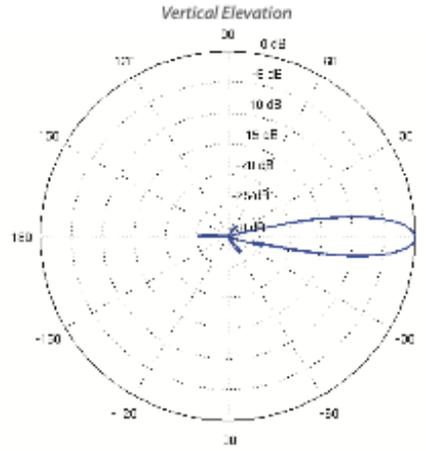
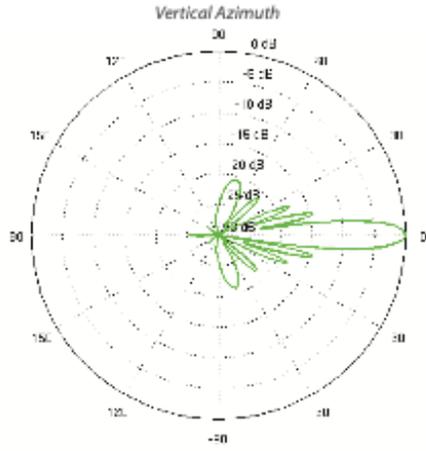
Highly Efficient Antenna Beam Performance

Up to 450+ Mbps Throughput

Dedicated Wi-Fi Radio for Management



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DATASHEET

PowerBeam **AC GEN2**

Specifications

PBE-5AC-Gen2		
Dimensions	420 x 420 x 230 mm (16.54 x 16.54 x 9.06")	
Weight	2.22 kg (4.89 lbs)	
Power Supply	24V, 0.5A Gigabit PoE Adapter (Included)	
Max. Power Consumption	8.5W	
Power Method	Passive PoE (Pairs 4, 5+; 7, 8 Return)	
Supported Voltage Range	20 to 26VDC	
Gain	25 dBi	
Networking Interface	(1) 10/100/1000 Ethernet Port	
Processor Specs	MIPS 74Kc	
Memory	64 MB	
LEDs	Power, Ethernet, (4) Signal Strength	
Channel Sizes	PtP Mode	PtMP Mode
	10/20/30/40/50/60/80 MHz	10/20/30/40 MHz
Enclosure Characteristics	Antenna Feed	Dish Reflector
	Outdoor UV Stabilized Plastic	Powder-Coated SPCC
Mounting	Pole-Mounting Kit (Included)	
Wind Loading	380 N @ 200 km/h (85.4 lbf @ 125 mph)	
Wind Survivability	200 km/h (125 mph)	
ESD/EMP Protection	Air: ± 24 kV, Contact: ± 24 kV	
Operating Temperature	-40 to 70° C (-40 to 158° F)	
Operating Humidity	5 to 95% Noncondensing	
RoHS Compliance	Yes	
Salt Fog Test	IEC 68-2-11 (ASTM B117), Equivalent: MIL-STD-810 G Method 509.5	
Vibration Test	IEC 68-2-6	
Temperature Shock Test	IEC 68-2-14	
UV Test	IEC 68-2-5 at 40° C (104° F), Equivalent: ETS 300 019-1-4	
Wind-Driven Rain Test	ETS 300 019-1-4, Equivalent: MIL-STD-810 G Method 506.5	
Certifications	CE, FCC, IC	

Operating Frequency (MHz)				
Worldwide	5150 - 5875			
USA	U-NII-1: 5150 - 5250	U-NII-2A: 5250 - 5350 MHz	U-NII-2C: 5470 - 5725 MHz	U-NII-3: 5725 - 5850

Management Radio (MHz)	
Worldwide	2412 - 2472
USA	2412 - 2462

PBE-5AC-Gen2 Output Power: 24 dBm							
TX Power Specifications				RX Power Specifications			
Modulation	Data Rate	Avg. TX	Tolerance	Modulation	Data Rate	Sensitivity	Tolerance
airMAX ac	1x BPSK (½)	24 dBm	± 2 dB	airMAX ac	1x BPSK (½)	-96 dBm Min.	± 2 dB
	2x QPSK (½)	24 dBm	± 2 dB		2x QPSK (½)	-95 dBm	± 2 dB
	2x QPSK (¾)	24 dBm	± 2 dB		2x QPSK (¾)	-92 dBm	± 2 dB
	4x 16QAM (½)	24 dBm	± 2 dB		4x 16QAM (½)	-90 dBm	± 2 dB
	4x 16QAM (¾)	24 dBm	± 2 dB		4x 16QAM (¾)	-86 dBm	± 2 dB
	6x 64QAM (½)	22 dBm	± 2 dB		6x 64QAM (½)	-83 dBm	± 2 dB
	6x 64QAM (¾)	21 dBm	± 2 dB		6x 64QAM (¾)	-77 dBm	± 2 dB
	6x 64QAM (%)	21 dBm	± 2 dB		6x 64QAM (%)	-74 dBm	± 2 dB
	8x 256QAM (¾)	20 dBm	± 2 dB		8x 256QAM (¾)	-69 dBm	± 2 dB
8x 256QAM (%)	20 dBm	± 2 dB	8x 256QAM (%)	-65 dBm	± 2 dB		

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cnPilot™ R190W Cloud managed Home Routers for ISPs SPECIFICATION SHEET



cnPilot R190W Cloud managed Home Router for ISPs

The IPV6 capable R190W is ideal for cost-conscious service providers seeking a standard, entry level home router with cutting edge cloud management and robust features. The R190W can be remotely configured, monitored, and upgraded, and offers in-home client insights that make troubleshooting a breeze – all reducing the ISP's need for site visits.



MAKING THE CASE - RETURN ON INVESTMENT (ROI)

It's estimated that over 60% of customer complaint calls to service providers (SPs) for "poor internet service" result from unmanaged home routers, purchased and deployed by end customers themselves.

Service providers lose money servicing these complaints with no visibility to the indoor home router, with no improvement in customer satisfaction, high subscriber churn, or ability to recover lost revenue opportunities. The R190W gives service providers more options than ever, enabling them to:

- Enhance customer satisfaction by offering standardized SP- validated and managed indoor home routers that connect users to the internet rapidly and efficiently.
- Sell or lease the R190W as the ISP provided router to subscribers, creating a new line of revenue. The low capex of these routers ensures a rapid return on investment.
- Reduce service call costs with client visibility via cnMaestro with the ezView tool. Track and manage customer inventory, and see attached clients and RSSI information remotely – enabling fast customer support.

REMOTE CLOUD OR ON-PREMISES MANAGED

The cnPilot R190W solution can be deployed with Cambium's cnMaestro™ cloud controller or On-premises controller versions, offering:

- Zero touch onboarding
- Inventory tracking and monitoring
- Dashboard views with alarms
- Remote mass upgrade
- TR-069 & SNMP management

ezVIEW: TROUBLESHOOTING

With ezView, cnMaestro offers rich client and device troubleshooting capabilities integrated with ongoing management. When backhauled wirelessly, ezView's single-pane-of-glass display shows data from clients, the Wi-Fi router (R190W), and the ePMP or PMP 450 wireless links backhauling the router.

IPV4 & IPV6 – FOR TODAY AND TOMORROW

The R190W supports modern IPV6 network topology

LICENSE-FREE ROUTER. ONE LOW PRICE.

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Joint Broadband Project

cnPilot™ R190W Cloud managed Home Routers for ISPs SPECIFICATION SHEET

SPECIFICATIONS

VoIP SoC	MIPS Single-core 580MHz
Flash	16MBytes Flash
RAM and CPU	<ul style="list-style-type: none"> 64MBytes DDR3 RAM MT7628N
Power Supply	<ul style="list-style-type: none"> AC/DC Adapter AC Input: 100-240V, 50-60Hz DC Output: 12V, 1.0A
I/O Interfaces	<ul style="list-style-type: none"> 1 RJ-45 for WAN port (Ethernet 100 Base-T) 4 RJ-45 for LAN port (Ethernet 100 Base-T)
Environmental	<ul style="list-style-type: none"> Operation Temperature: -5-45 Degree C Storage Temperature: -25- 85 Degree C Relative Humidity: 10%-90% No Condensing
Key Feature	<ul style="list-style-type: none"> 100Mbps NAT/NAPT speed 2T2R 2.4GHz IEEE 802.11 b/g/n(300 Mbps)
Protocols	<ul style="list-style-type: none"> DHCP/PPPoE HTTP Server for Web Management TFTP/HTTP for Auto Provisioning DHCP Option Codes for SIP (RFC3361) DNS/DNS SRV (RFC1706 and RFC 2782) IEEE802.1Q VLAN/802.1p and IP DSCP SNTp
Wireless	<ul style="list-style-type: none"> 4 SSID Static WEP(64/128bit) Dynamic WEP(64/128bit) AES/TKIP MAC certification WEP certification WPA/WPA2 AP Isolation and MBSSID AP Isolation WMM WDS WPS MAC Filter(different from wired MAC Filter)
Applications	<ul style="list-style-type: none"> Support NAT mode and Bridge mode Support DDNS MAC address cloning Built-in Wired speed NAT Router DHCP Server and Client IP conflict detection Port Forwarding, DMZ, SuperDMZ 802.1Q VLAN/802.1p, DSCP, Rate Limiting VPN (PPTP,L2TP, IPSec) Passthrough SNTp IGMPv2 Firewall (SYN Flooding, IP Spoofing, Smurf Attack, Ping of Death, DoS)
Management	<ul style="list-style-type: none"> Firmware Upgrade Web Management Interface Local and Remote Syslog (RFC3164) Auto Provisioning SNTp Time Synchronization Multi User Level SNMP v2 Telnet TRO69 System Log: local log and remote log

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cnPilot R190W v0.3 05082017

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We at Virginia Air Networks appreciate the opportunity presented with the release of this RFP. If any further questions, please feel free to contact me personally.

Respectfully Submitted,

Joe Jones
Vice President
Virginia Air Networks