

Telecommunications Transmission Facility
Committee
Tower Coordinator Recommendation

Application Number: 20240112367 **Type:** New **Received (date):** 12/17/2024

Revised: 01/28/2025

Revised: 01/29/2025

Applicant: Network Towers II, LLC on behalf of Verizon Wireless

Site Name/Location: Colesville Depot/14335 Cape May Road, Silver Spring

Zoning Standard: RE-2C **Property Owner:** Network Towers II, LLC

Description: Install 179' monopole and install the following existing equipment to the proposed monopole: (6) JMA MX06FHG865-HG and (3) Samsung MT6413-77A. (1) Charles PM63912TN1 radio cabinet, (1) Charles LT-BB24/BB48 battery cabinet, and (1) proposed propane tank would be added on the ground near the monopole.

Tower Coordinator Recommendation: Recommended. Recommendation is subject to compliance with all applicable laws.

Signature:

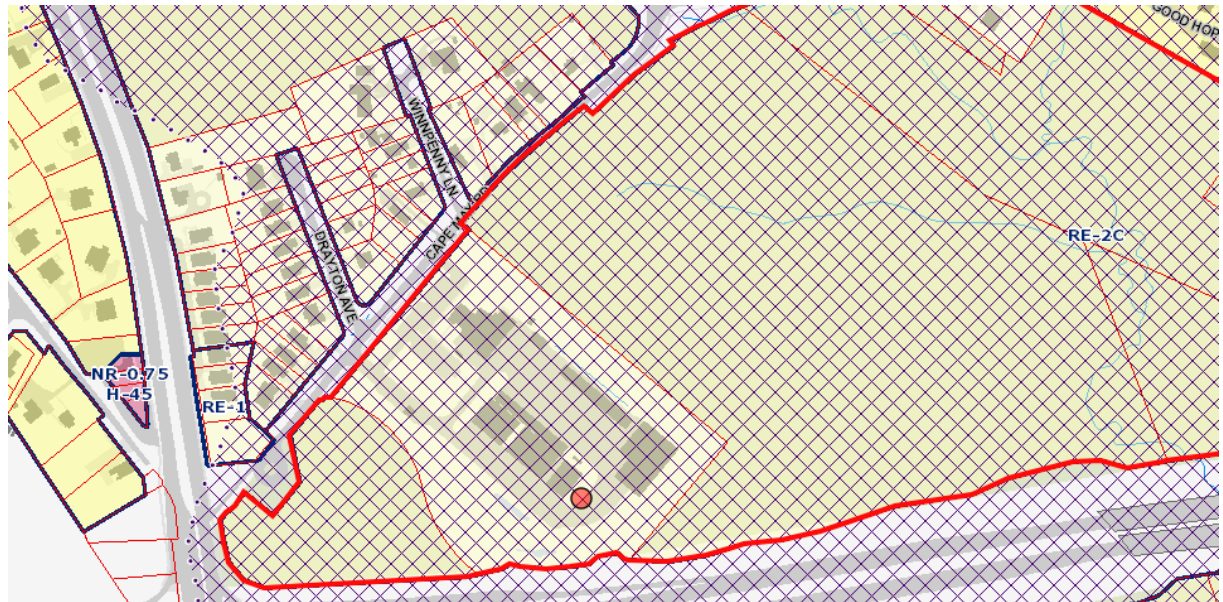
A handwritten signature in blue ink, appearing to read "Span".

Date: 01/31/2025

Impact on land-owning agency: Montgomery County

Existing or future public safety telecommunications facilities and plans: N/A

Implications to surrounding area: The MCAtlas zoning map below shows the location of the proposed monopole (circled) along with the general vicinity.



The location is near Maryland Route 200. An existing paved entrance and driveway leads to the proposed site. This monopole will be installed to hold the antennas of Verizon Wireless and two other carriers (T-Mobile and AT&T). Letters of intent have been provided by these carriers.

The applicant provided photo simulations from eighteen perspectives illustrating that the proposed monopole would have a limited visual impact to the surroundings. Existing trees and foliage will assist in mitigating the visual impact. A January 7, 2025, site survey confirmed the monopole would have minimal visibility to the surrounding area.

Colocation options: Verizon Wireless submitted RF propagation maps showing the diminished coverage areas and some nearby existing sites that were considered. Our review also considered fifteen existing wireless sites within a one-mile radius of the proposed location. Along with the maps provided, Verizon Wireless's explanations regarding the reasons each site would not be suitable or available for colocation were reviewed and documented in the application.

The revised RF maps submitted demonstrate the need for a monopole with RAD centers at 174' due to the coverage degradation at lower heights specifically along Maryland Route 200.

Attachments: Application

Comments: The applicant submitted a revised Radio Frequency Electromagnetic Energy (RF EME) Report dated January 29, 2025, that notes the proposed installation complies with FCC regulations. The report finds that neither the occupational nor the general population limits for radio frequency exposure will be exceeded at ground level and nearby walking surfaces using worst-case predictive modeling. Our review of this report found no inconsistencies.

The monopole is designed to host Verizon Wireless at the 174' RAD center and two other carriers. The facility will utilize the new proposed Verizon equipment pad, and the monopole will use a 30'x48' lease area with a fenced compound to house the Verizon ground equipment. Additionally, a lease area of 15'x25' would be used to house (1) proposed propane generator and (2) future propane generators. The proposed antennas meet the size requirements set forth in the Montgomery County Zoning Ordinance. DPS's review of the application noted that the new tower requires Conditional Use approval from Hearing Examiners. The proposed tower and antennas meet the size and mounting height requirements set forth in the Montgomery County Zoning Ordinance.

Our review of the application concludes that there is a coverage gap in the area (specifically along Route 200) and a new site would be needed to fill the coverage gap. The review included a thorough examination of not only Verizon Wireless's technical evidence but an assessment of existing wireless sites in the area that might offer relief. However, our evaluation found that no other sites were available to provide the needed coverage.

In conclusion, we find that the proposed monopole structure will be able to provide sufficient coverage to mitigate the existing coverage gap. We recommend this application on its merits from an engineering review perspective.

App No:

2024112367

Revisions received 1.28.25 - JE

Revisions received 1.29.25 - JE

Application General Information

Applicant Name	Network Towers II, LLC	Received	12/17/2024
Application Type	New	Ann. Plan?	Yes
Carrier	Verizon Wireless	Will site be used to support government telecommunications facilities or other equipment for government use?	No
Solution Type	Macro		
Existing	New		
		Gvt. Use Desc.	

Application Description

This application is for a new 179' 3-sector monopole to be leased, zoned, permitted and maintained by Network Towers , LLC at 14335 Cape May Road, Silver Spring, MD at Montgomery County's Coles ville depot. The lead carrier is Verizon. 3 Carriers are interested in locating on this structure-Please attached Letters of intent from AT&T and T-Mobile. Verizon is the lead carrier. Verizon proposes to install (6) JMA Wireless MX06FHGH865-HG antennas (2 per sector), (3) Samsung MT6413-77A antenna/RRH combo units (1 per sector). The total proposed lease area is 1815 SF (30'x48' for ground equipment and 15'x25' for potential propane tanks. Verizon's lease area for ground equipment will be 12.5' x 21' Concrete pad. There are (2) Charles equipment cabinets/Cubs proposed- a Charles PM63912TN1 for the radio equipment and a Charles LI-BB24/BB48 Battery Cabinet- see attached updated site plan dated 1/23/25

Site Information

Site Id	798	Zoning	RE-2C
Structure Type	Monopole	Latitude	39.0897
Street Address	14335 Cape May Road	Longitude	-76.9962
County Site Name	Colesville Depot	Ground Elevation	454
Carrier Site Name	Castle Cliff	City	Silver Spring
Site Owner	Montgomery County	Lease Status	In Process
Structure Owner	To Be built Tower- Network Towers II	Does the structure require an antenna structure registration under FCC Title 47	No
Existing Structure Height		Distance to Residential Property (New, Colocation Only)	775
Provide the proposed height of the new structure without any antenna (New Apps Only)	179'	Distance to Commercial Property (New, Colocation Only)	1143

Justification of why this site was selected:

This search ring has been worked on by all 3 major carriers over the last 10 plus years. All 3 are have committed to colocate on this structure if built. This site borders the ICC Route. Approximately 60,000 cars ravel on this highway daily. The location is >95% residential or Parklands. There was over 25 locations reviewed- 14 of the alternate sites are listed below- no existng sites were found. This is the most commercial property that could work.

NearbySites (New Apps Only):

See list of alternate sites considered on next page.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

Screening considerations(New, Colocation Apps Only):

The site will be occupied by at least 3 carriers and is projected to be a 179' monopole. The Colesville Depot site is a Montgomery County Maintenance yard with heavy equipment, road salt storage, with moderate to heavy traffic going in and out. The site is surrounded by trees on 3 sides and borders the ICC on the south side. Due to the limited commercial or industrial sites in the area- this site is located in the rear of the site- but allows for a 1:1 setback from the ICC side property line. The closest residential property is 775' away to the NNW. Our balloon test consisted of 22 locations. Only 4 were visible. None were visible from 1 mile away.

Some of the Nearby Alternate Sites Considered:

1. Good Hope United Methodist Church- 14680 Good Hope Rd Silver Spring MD- Church board voted against tower
2. Charles Drew Elementary School- 1200 Swingingdale Dr Silver Spring MD- No Interest- Safety Concerns
3. Colesville Local Park/ MD child services- 610 Hobbs Dr Colesville Md- Montgomery County Parks made determination that location was not suitable for a tower
4. Peach Wood Park- 39.097184, -76.996847- Montgomery County Parks made determination that location was not suitable for a tower
5. Good Hope Community Center- 14715 Good Hope Rd Silver Spring MD- Montgomery County denied the tower at the community center
6. Good Hope Local Park- 39.096295, -76.984786- Montgomery County Parks deemed that the location was not suitable for a tower
7. Washington Zion Presbyterian Church- 14655 Good Hope Rd Silver Spring Md- No interest
8. MDOT Property on ICC- 39.08984/-76.9867- MDOT rejected due to safety concerns
9. Transfiguration Church- 13925 New Hampshire Ave Silver Spring Md- Interested in Raw land but not much room and tough zoning case with setbacks and Just out of search ring
10. Fire Alliance Church- 14500 New Hampshire Ave Silver Spring Md- Currently Tmobile in Steeple- only 40' high. Landlord is open to Rawland but said they have future plans for property where tower could go - outside of search ring
11. Heyser Farms- 14526 New Hampshire Ave Silver Spring Md- Landlord not interested and Out of search ring
12. MDOT Location along the **ICC** Highway- 39.089421, -76.983101- rejected by MDOT.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

6409 Questions

Does this qualify as a 6409 application? (Minor Mod, Colocations Only)

For towers outside the public ROW will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 20 feet, whichever is greater?

Will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 6 feet?

For towers outside the public ROW will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 20 feet?

Will the proposed installation require more the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets?YN

Will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 10 feet, whichever is greater?

Does the structure or current installation have concealment elements/measures?

Will the proposed installation require excavation or expansion outside the current boundaries of the site?

If yes, describe how the proposed installation does not defeat the existing concealment.

Small Wireless Facility Information

Small Wireless Facility Questions

Small Wireless Facility?

Is the structure 10% taller than adjacent structures?

Cumulative volume of the proposed wireless equipment(s) exclusive of antennas in cubic feet

Please list adjacent structure heights

Cumulative volume of the proposed antenna(s) exclusive of equipment in cubic feet

Tribal Lands?

ROW Information

PROW?

Pole Number

ROW owner

ROW width

Wednesday, December 18, 2024

7:49:12 PM

Antenna Information

Antenna Compliance

Yes

Compliance Desc

Antenna Location

No

Antenna Loc. Desc.

Env. Assessment

Cat. Excluded?

Routine Env. Evaluation

Yes

Antenna Model

JMA MX06FHG865-HG

Frequency

RAD Center

174

Max ERP

14791 W

Antenna Dimensions

96"x12.2"x7.5"

Quantity

6

Antenna Model	Samsung MT 6413-77A						
Frequency							
Rad Center	174'	Max ERP	30903 W	Antenna Dimensions	15.75" X 28.9" X 5.51"	Quantity	3

Frequency band	Band	EARFCN	DL Range Mhz	UL Range Mhz	Antenna
700 upper C	B 13	5230	746-756	777-787	JMA MX06FHG865
850	B 5	2560	880-890	835-845	JMA MX06FHG865
PCS	B 2	1125	1975-1990	1895-1910	JMA MX06FHG865
AWS	B 4	2125	2120-2135	1720-1735	JMA MX06FHG865
AWS3	B 66	67086	2170-2180	1770-1780	JMA MX06FHG865
C-Band	B n77	650006;655324	3700-3860	3700-3860	Samsung MT6413-77A



International Maryland Fence

Heyser Farms, Inc

GOO

Florine Professional Hair Braiding

Spring Bunnies Family Home Daycare

CITGO AT ICC

Castle Cliff Monopole

14335 Cape May Rd

McCo Colesville Depot

200

200

Quality Insulation

Colesville Manor Dr

Casa De Montessori

Image NASA

Colesville Local Park

778 ft

Hobbs Dr

Hobbs Dr

lat 39.106765° lon -77.016150° elev

102 MMU Product Specification

for MT6413-77A

Describes the product components, physical nature, functions, specifications, ports, and LED information, and their characteristics as a reference for installation and O & M activities

© 2023 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

70315

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

TIMS@sea.samsung.com

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	viii
	Personal and Product Safety	ix
	Equipment Markings	xiii
Chapter 1	Introduction	1
	Overview	1
	Functional Description	3
	<i>Clock</i>	3
	<i>Cooling</i>	3
	Specifications	4
Chapter 2	External Interface	6
	Port Information	6
	LED Operation	7
Appendix	Acronyms	9

70315

List of Figures

Figure 1.	MT6413-77A Appearance	1
Figure 2.	Block Diagram	3
Figure 3.	MT6413-77A Port Information.....	6
Figure 4.	MT6413-77A LED Information	7

70315

List of Tables

Table 1. Name and Description of Units 2

Table 2. Specifications of the MT6413-77A 4

Table 3. MT6413-77A Port Information..... 6

Table 4. SYS LED 7

Table 5. OPT LED 8

Table 6. PWR LED 8

70315

Preface

This document describes the MT6413-77A of Massive MIMO Unit (MMU) in a 5G network.

The document provides information useful to network operators during the installation, operation, and management cycles. It includes information such as the radio unit functions, hardware configuration, ports, and LED information.



Some hardware configurations are not supported by all software releases or approved for all markets.

Relevance







This manual applies to the following products/software.

Name	Type
MT6413-77A (3.7 GHz)	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`.
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STs**, **eutran-cell-conf-idle**, or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	February 2023	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the hardware overview, functional description, and general specification of the product.
Chapter 2	External Interface	This chapter describes the external interfaces of the radio unit in detail.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 101 5G gNB System Description
- 201 5G gNB Dimensioning and Configuration Manual
- 310 MMU Installation Manual for MT6413-77A

70315

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by UL 62368-1. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under UL 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors—cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed in order to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with UL 62368-1, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of UL 62368-1 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery.

End-of-life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California, USA.

‘Perchlorate Material-special handling may apply; see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

70315

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

MMU should be grounded.

Chapter 1 Introduction

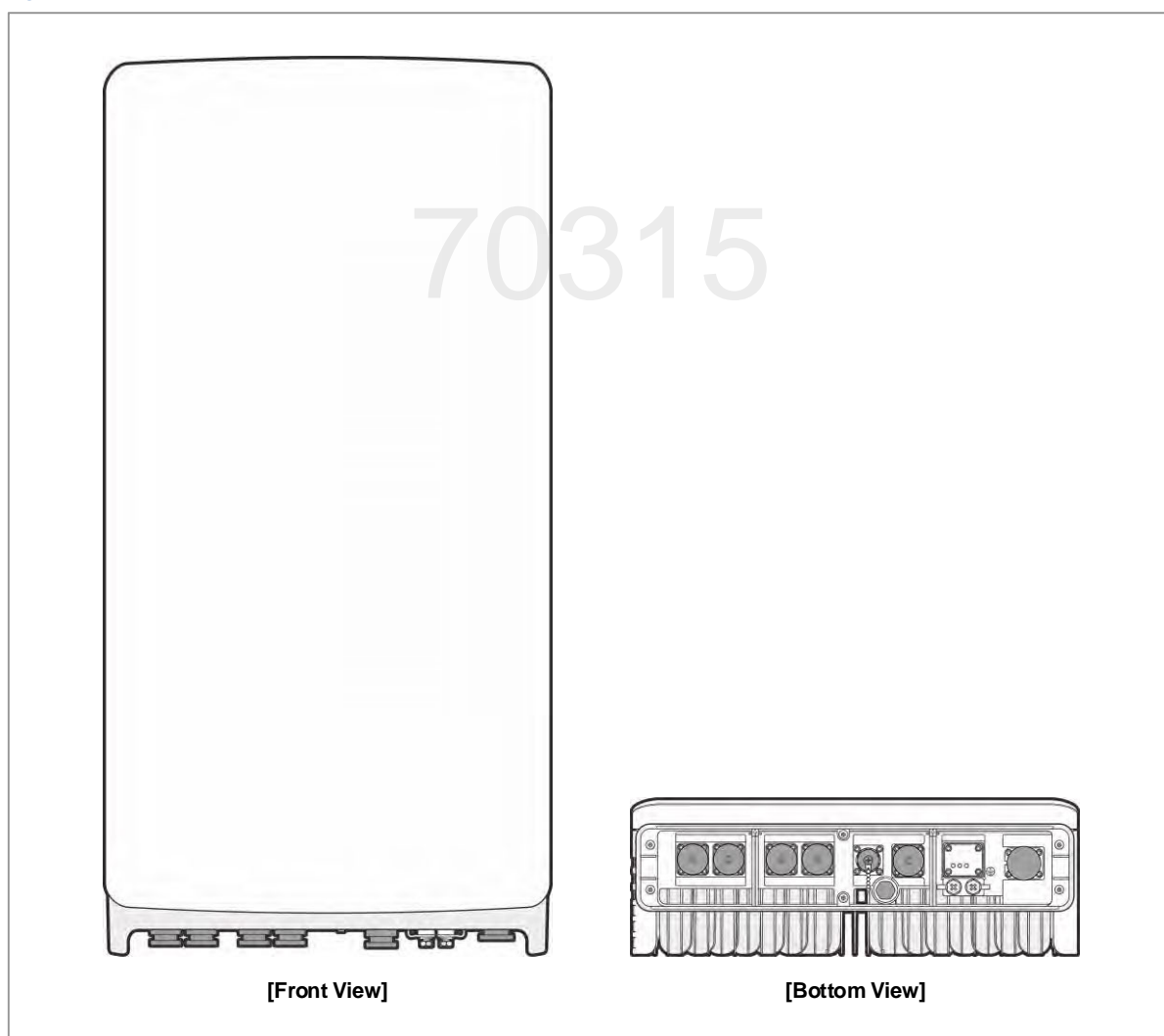
This chapter provides the hardware overview, functional description, and general specification of the product.

Overview

The MT6413-77A is a Massive MIMO Unit (MMU) consisting of digital and radio blocks. The digital block supports the interface with Digital Unit (DU) and the Low-PHY function (functional split option 7-2). The radio block transmits and receives the Radio Frequency (RF) signals with an integrated 64T64R antenna.

The following figure depicts the appearance of the MT6413-77A.

Figure 1. MT6413-77A Appearance



The following table outlines the name and description of the MT6413-77A.

Table 1. Name and Description of Units

Model Name	Description
MT6413-77A	3.7 GHz NR 64T64R 320 W MMU



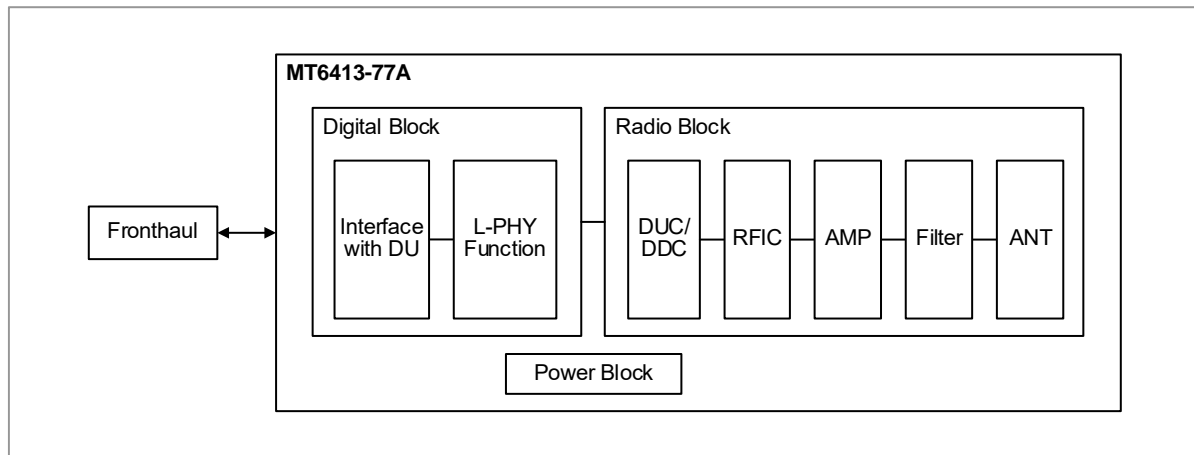
Some hardware configurations are not supported by all software releases or approved for all markets.

70315

Functional Description

The following figure depicts the block diagram of the MT6413-77A.

Figure 2. Block Diagram



The MT6413-77A consists of the digital block, the radio block, and the power block. The digital block consists of the interface block and the L-PHY block. The digital block supports the interface with the DU, operation, and management of the MT6413-77A and processes the L-PHY function, such as precoding, digital beamforming, iFFT FFT, and so on.

The radio block consists of the digital up/down converter, RFIC (digital/analog converter), amplifier, filter, and 64T64R antenna.

Clock

The MT6413-77A supports CPRI clock recovery and IEEE1588v2/SyncE synchronization.

The MT6413-77A receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the MT6413-77A generates and distributes the clock for internal devices.

Cooling

The MT6413-77A uses a natural convection cooling method without using a fan.

Specifications

The following table displays the main specifications of the MT6413-77A.

Table 2. Specifications of the MT6413-77A

Item		MT6413-77A
Air Technology		5G
Band/Duplex		n77/TDD
OFR		3,700 to 3,980 MHz
IBW		200 MHz
OBW		200 MHz
Carrier Configuration	Ch. BW	NR 20/40/60/80/100 MHz
	Number of carriers (per unit)	2CC
TRX Path Configuration		64T64R
Antenna Configuration		4V16H 192 AE (3 x 1 sub-array)
Conductive Power		320 W
MIMO Capacity		DL 16L, UL 16RX (8L)
Function Split		Opt. 7-2x
Optic Interface		20 km, 25 Gbps × 4 ports
Input Voltage		48 V DC (-36 to -58 V DC)
Power Consumption ^{a)}		<ul style="list-style-type: none"> • 8.2 W @ 40 % room temp • 1,260 W @ 100 % room temp • 1,299 W @ 100 % all temp
Volume / Dimension (W x H x D)		41.1 L / 15.75 x 28.9 x 5.51 in. (400 x 734 x 140 mm)
Weight		57.32 lb (26 kg) or less (without a Bracket)
Operating Temperature ^{b)}		-104 °F to +131 °F (-40 °C to +55 °C), (without solar load)
Cooling Scheme		Natural Convection
Installation		Pole, Wall
Operating Humidity ^{b)}		5% to 100% RH (non-condensing, not to exceed 30 g/m ³ absolute humidity)
Altitude		Telcordia GR-63-CORE, Issue 5, Section 4.1.3
Noise		Telcordia GR-487-CORE, Issue 5, Section 3.34 (45 dBA)
Ingress Protection Rating		IEC 60529 (IP65)
Salt Fog / Salt Spray		Telcordia GR-487-CORE, Issue 5, Section 3.40.1
Wind Resistance		Telcordia GR-487-CORE, Issue 5, Section 3.36
Earthquake		Telcordia GR-63-CORE, Issue 5, Section 4.4.1 (Zone 4)
Vibration		Telcordia GR-63-CORE, Issue 5, Section 4.4.4 / 4.4.5
EMC		FCC Title 47 CFR Part 15 Subpart B

Item	MT6413-77A
Safety	UL 62368-1
RF	FCC Title 47, CFR Part 27



1) These values are predictive of simulation. When development is completed, measurement data can change by +/- 10%.



2) Temperature and humidity are measured 1.5 m above the floor and 400 mm from the equipment's front panel.

70315

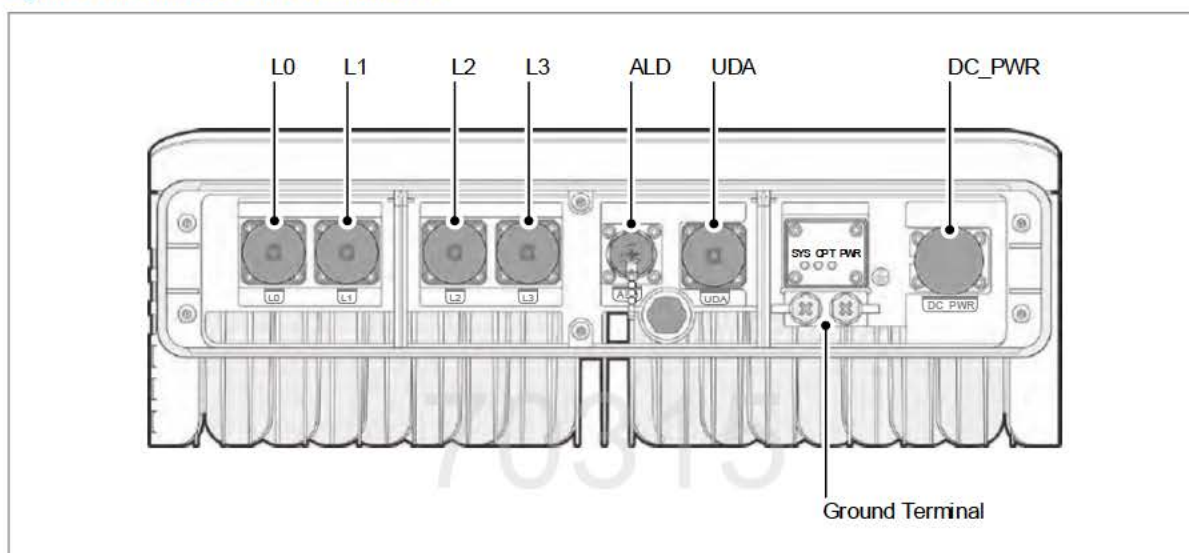
Chapter 2 External Interface

This chapter describes the external interfaces of the radio unit in detail.

Port Information

The following figure depicts the port information of the MT6413-77A.

Figure 3. MT6413-77A Port Information



The following table outlines the port information of the MT6413-77A.

Table 3. MT6413-77A Port Information

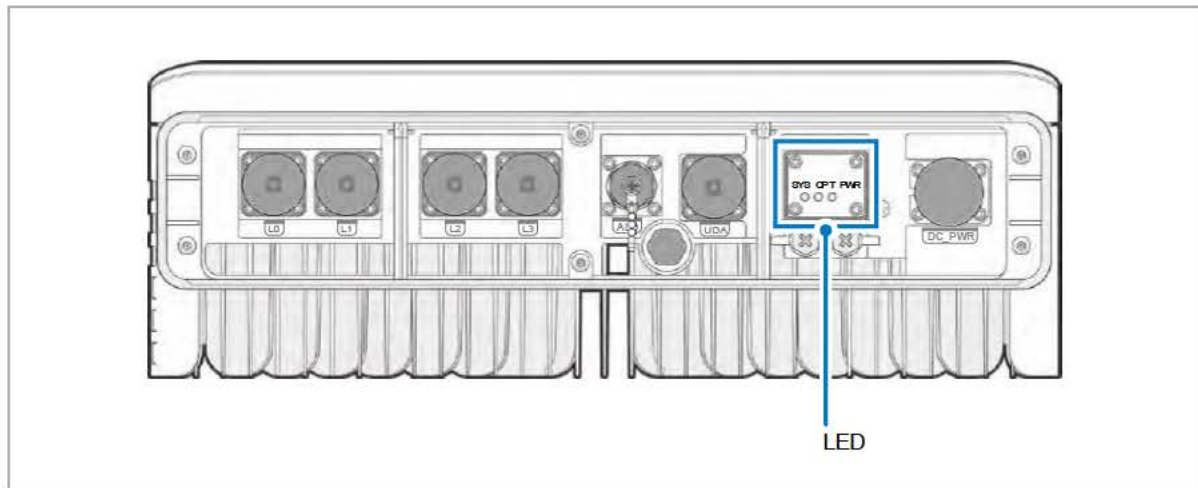
Port Name	Connector Type	Description
L0, L1, L2, L3	Push pull, SFP28 type	25GbE fronthaul optic interface
UDA	Push pull, RJ45 type	User-defined alarm (4 Rx)
DC_PWR	Push pull	-48 VDC (-36 to -58 VDC)
SYS, OPT, PWR	LED	Status LED for system, optic, power

LED Operation

The MT6413-77A displays the device status through the LED.

The following figure depicts the LED position of the MT6413-77A.

Figure 4. MT6413-77A LED Information



The following table describes the meaning of different LED states.

Table 4. SYS LED






Status	Description	
	Solid Red	<ul style="list-style-type: none"> Abnormal condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The CPRI link is not set up. The RU initialization is in progress (all paths are disabled).
	Blinking Red	<ul style="list-style-type: none"> Imperfect condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and at least one path functions properly.
	Solid Green	<ul style="list-style-type: none"> Standby condition No path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The RU initialization is complete and ready to send the notification message to the DU.
	Blinking Green	<ul style="list-style-type: none"> Normal condition No path has been shut down by a major alarm or disabled alarm, and at least one path functions properly. At least one carrier in the path functions properly in a multi-carrier case.
	Off	No DC input power

Table 5. OPT LED











Status		Description
	Solid Red	Optic RX LOS or optic Tx fault at all ports
	Blinking Red	Optic RX LOS or optic Tx fault at one of the port
	Solid Green	No optical module insert
	Blinking Green	No alarm, normal condition
	LED OFF	No DC input power

Table 6. PWR LED

Status		Description
	Solid Red	Shut down by Voltage High/Low major alarm.
	Blinking Red	Reserved.
	Solid Green	Reserved.
	Blinking Green	No alarm, normal condition
	OFF	No DC input power



70315

Appendix Acronyms

ADC	Analog to Digital Converter
AMP	Amplifier
ANT	Antenna
CPRI	Common Public Radio Interface
DDC	Digital Down Converter
DU	Digital Unit
DUC	Digital Up Converter
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
gNB	next generation Node B
LED	Light Emitting Diode
L-PHY	Low Physical Layer
MMU	Massive MIMO Unit
NR	New Radio
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
RU	Radio Unit
SFP	Small Form Factor Pluggable
UDA	User Defined Alarm

70315

102 MMU
Product Specification for MT6413-77A

Document Version 1.0

© 2023 Samsung Electronics Co., Ltd.
All rights reserved.

102 RRU Product Specification

for RF4439d-25A

Describes the product components, physical nature, specific functions, specifications, ports and LED information along with their characteristics as a reference for installation and O&M activities.

Document Version 1.0
July 2021

© 2021 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

[NetSys Tech Writer@sea.samsung.com](mailto:NetSys_Tech_Writer@sea.samsung.com)

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	vii
	Personal and Product Safety	viii
	Equipment Markings	xii
Chapter 1	Introduction	1
Chapter 2	Overview	2
	Functional Description	4
	Hardware Block Diagram.....	4
	Clock.....	5
	Cooling	6
	<i>AISG 3.0</i>	6
	Specifications	7
Chapter 3	External Interface	9
	<i>LED Information</i>	10
	<i>Port Information</i>	11
Appendix	Acronyms	12

List of Figures

Figure 1.	Appearance	3
Figure 2.	4Tx/4Rx RRU Block Diagram.....	5
Figure 3.	AI SG Interface	6
Figure 4.	External Interface	9

List of Tables

Table 1.	Name and Description of Units	2
Table 2.	Specifications (RF4439d-25A)	7
Table 3.	RF4439d-25A SYS LED Information	10
Table 4.	RF4439d-25A OPT LED Information	10
Table 5.	RF4439d-25A ANT LED Information	10
Table 6.	RF4439d-25A RET LED Information	11
Table 7.	RF4439d-25A Port Information	11

Preface

The Samsung eNB consists of Digital Unit (DU) and Remote Radio Unit (RRU). This manual describes the product components and is used as the reference for installation and O&M. It specifies the hardware configuration, functions, specifications, physical ports, and LED information of the RRU hardware.



Few hardware configurations are not supported by all the software releases or approved for all the markets.

Relevance

This manual applies to the following products/software.

Name	Type
RF4439d-25A PCS/AWS FDD 4Tx/4Rx RRU	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, context <designated epc-context-name>
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STs**, **eutran-cell-conf-idle** or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	July 2021	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the introduction.
Chapter 2	Overview	This chapter provides the hardware overview, functional description, and general specifications.
Chapter 3	External Interface	This chapter describes the LED information, and the port information of the Radio Unit.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 201 LTE eNB Dimensioning and Configuration Manual
- 101 LTE eNB System Description
- 310 LTE RU (RRU) Installation Manual

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by IEC/EN/UL/CSA 62368 or 60950. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under EN 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with IEC/EN/UL/CSA 62368 or 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of IEC/EN/UL/CSA 62368 or 60950 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery.

End of life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California USA.

‘Perchlorate Material-special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

RRU should be grounded.

Chapter 1 Introduction

The Samsung eNB consists of the Digital Unit (DU) and the Radio Unit (RU). The DU is a digital unit and can be mounted in to an indoor or outdoor 19-inch commercial rack. The RU is a RF integration module consisting of a transceiver, power amplifier, and filter. It transmits and receives traffic, clock information, and alarm and control messages to and from the DU.

This document describes the product components, serving as the reference for installation and O&M. It specifies hardware configuration, functions, specifications, component ports, and LED information of the RU hardware component.

The document is divided into three chapters. An overview of all the chapters is given in this section.

- Introduction

This chapter provides an introduction of the document.

- Overview

This chapter describes the hardware overview, functional description, and general, mechanical and environmental specification for the RU products.

- Radio Units

This chapter describes hardware components of radio unit in detail, such as appearance of external interface, and detail information of ports and LED.

- Acronyms

This appendix spells out the acronyms used in this document.

Chapter 2 Overview

The Remote Radio Unit (RRU) consists of the RF chains of 4Tx/4Rx which is an integrated RF unit that includes a transceiver, a power amplifier, and a filter in an enclosure.

The following table outlines the name and description of the RRU (RU).

Table 1. Name and Description of Units

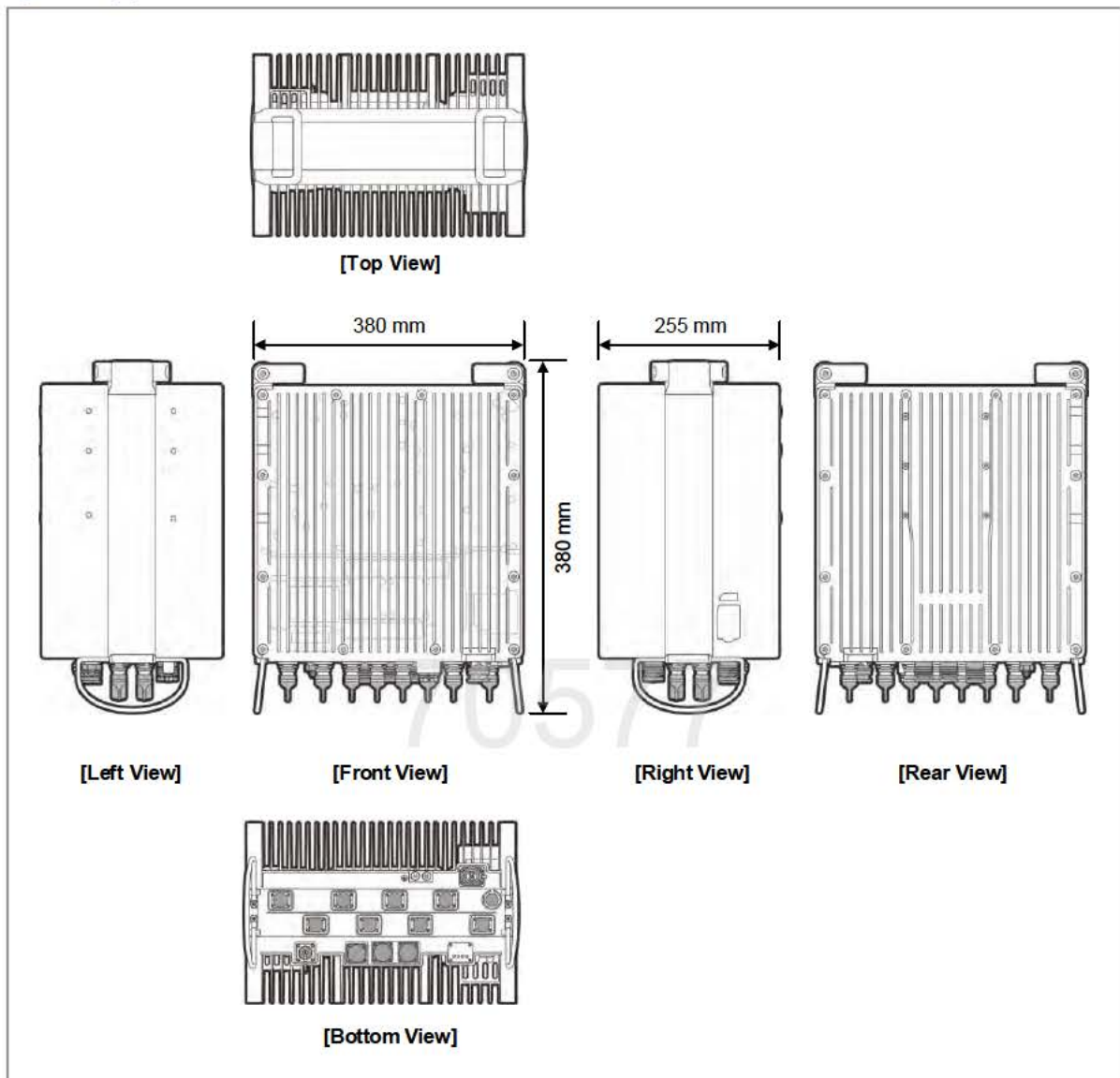
Model Name	Description
RF4439d-25A	PCS/AWS FDD 4Tx/4Rx RRU (RU)



Few hardware configurations are not supported by all the software releases or approved for all the markets.

The following figure depicts the physical view of the RRU (RF4439d-25A):

Figure 1. Appearance



Functional Description

In downlink path, the RRU performs Optical-to-Electrical (O/E) conversion for baseband signals received from the DU via the optic CPRI (SVR21C) or optic eCPRI (SVR21D). Then, the electrical digital signals are converted into analog signals by the DAC. The frequency of these analog signals is converted upward through the modulator and these signals are amplified into high-power RF signals through the power amplifier. The amplified signals are transmitted to antenna through the filter.

In uplink path, the RF signals received through filter of the RRU are low-noise amplified by the Low Noise Amplifier (LNA) and their frequency is down-converted through the demodulator. These down-converted frequency signals are converted into baseband signals through the ADC. The signals converted into baseband are changed to Electrical-to-Optical (E/O) and transmitted to the DU through the CPRI.

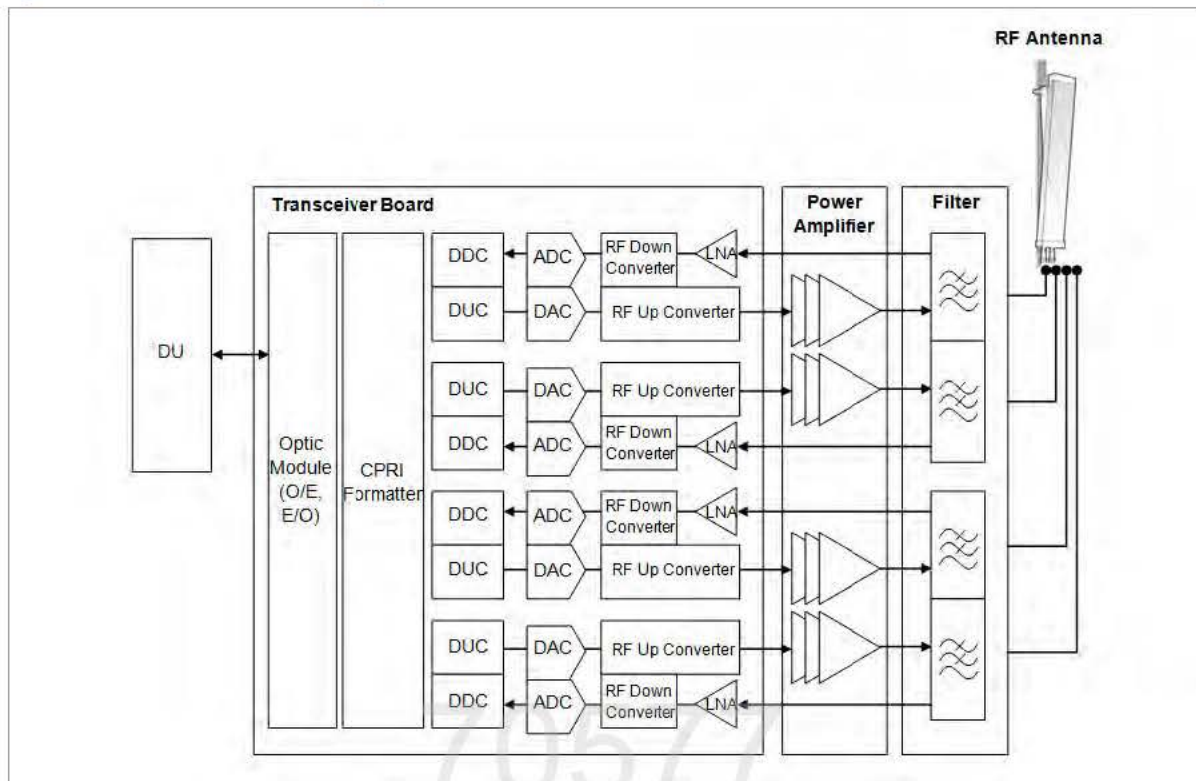
The DU transmits control signals to the RRU via the control path (channel) of the CPRI.

Hardware Block Diagram

The description for the block diagram is given in the above section.

The following figure is the block diagrams of 4Tx/4Rx RRU:

Figure 2. 4Tx/4Rx RRU Block Diagram



Clock

The RRU supports the CPRI clock recovery (SVR21C) and IEEE1588v2/SyncE synchronization (SVR21D).

The RRU receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the RRU generates and distributes the clock for internal devices.

Cooling

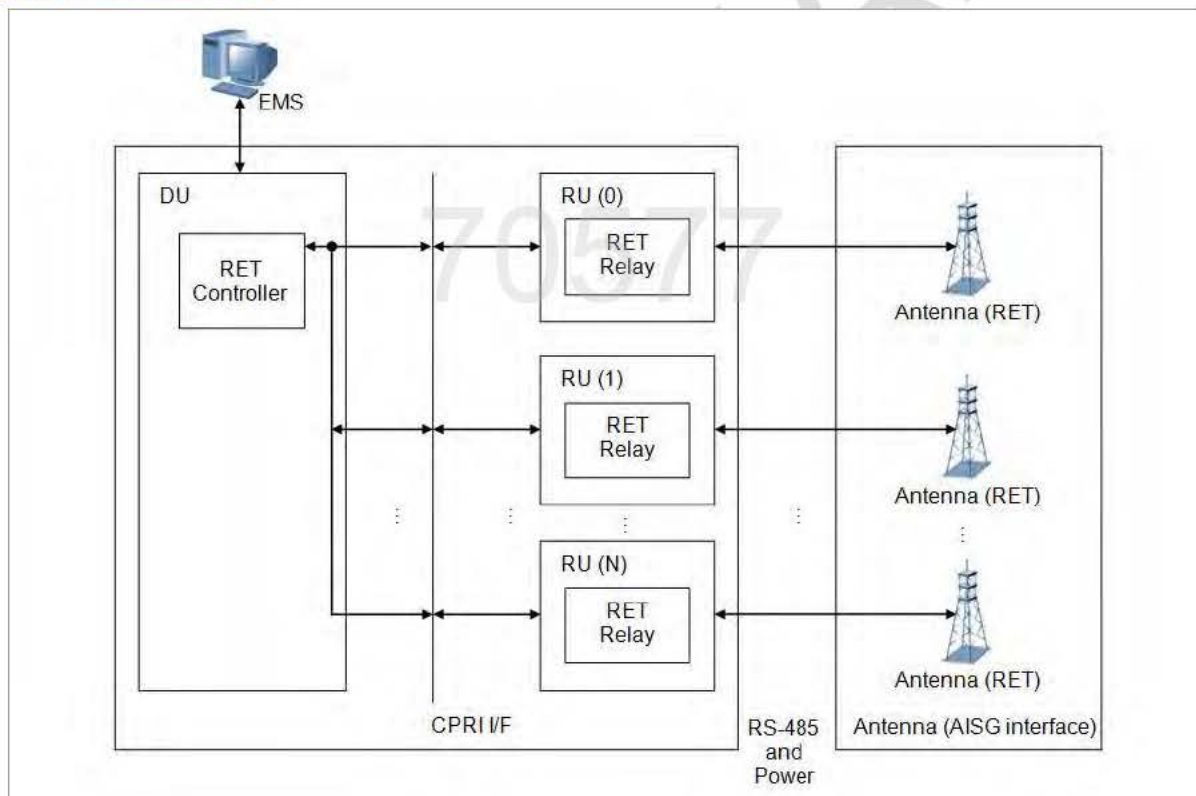
The RRU is designed to discharge the heat effectively through natural cooling without additional cooling devices.

AISG 3.0

The Samsung eNB can provide Remote Electrical Tilt (RET) function by connecting the AISG 3.0 interface-compatible antenna to the RRU.

For the RET function, the Samsung eNB transmits and receives control messages to and from the EMS via the RET controller in the Main Card. The EMS can remotely control the tilting angle of the antenna. In addition, the RRU provides power to the RET device of the antenna for the RET operation. Refer to the following block diagram:

Figure 3. AISG Interface



Specifications

The following table outlines the main specifications of RF4439d-25A.

Table 2. Specifications (RF4439d-25A)

Category		Description
Air Standard		LTE and 5G NR
Duplex Type		FDD
Antenna Port Configuration		For AWS/PCS band respectively, 4T4R: T/R T/R T/R T/R 2T4R: T/R T/R R R 2T2R: T/R T/R 2T2R + 2T2R 2sector
Operating Frequency	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,930 - 1,995 MHz B66(B4)/n66(n4): 2,110 - 2,200 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,850 - 1,915 MHz B66(B4)/n66(n4): 1,710 - 1,780 MHz
Channel Bandwidth ^{a)}		5/10/15/20 MHz (LTE/NR)
IBW	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4): 90 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4) : 70 MHz
Max number of Car iers		5/10/15/20 MHz 4T4R case: Total Max. 7CC within (PCS: 3CC, AWS: 5CC)
OBW		<ul style="list-style-type: none"> B25(B2)/n25(n2): 30MHz B66(B4)/n66(n4): 60MHz
Output Power		Max. 320 W within, <ul style="list-style-type: none"> B25(B2)/n25(n2): 40 W x 4 path or 60 W x 2 path B66(B4)/n66(n4): 60 W x 4 path or 80 W x 2 path
Fronthaul Interface		Optical (e)CPRI 2 port (10 Gbps x 2 port)
Function Split		DL/UL Option 8 (SVR21C) DL/UL Option 7-2x Cat.A (SVR21D)
Dimension (W x H x D)		380 x 380 x 255 mm (14.96 x 14.96 x 10.04 inch) Excluding connector, partial extrusion, flange
Weight (kg)		Under 33.9 (excluding bracket)
Cooling		Natural convection cooling
Input Voltage		-48 V DC (-38 V to -57 VDC)
Power consumption		<ul style="list-style-type: none"> Typical (W)-Load 100 % 1270 W @ room temp Maximum (W)-Load 100 % 1459 W @ all temp
Operating Temperature		<ul style="list-style-type: none"> -40 °C to 55 °C (without solar load) -40°C to 50°C (with solar load)
Operating Humidity		5% to 100%RH (Condensing, not to exceed 30g/m3 absolute humidity)
Installation		Pole, wall, tower, side-by-side, back to back

Category	Description
Vibration	Telcordia GR-63-CORE, Issue5, <ul style="list-style-type: none">• Office Vibration (Section 4.4.4)• Transportation Vibration (Section 4.4.5)
Ingress Protection Rating	IP65 (IEC 60529)
RF	FCC Title 47 CFR Part 27, 24
Safety	UL 62368-1



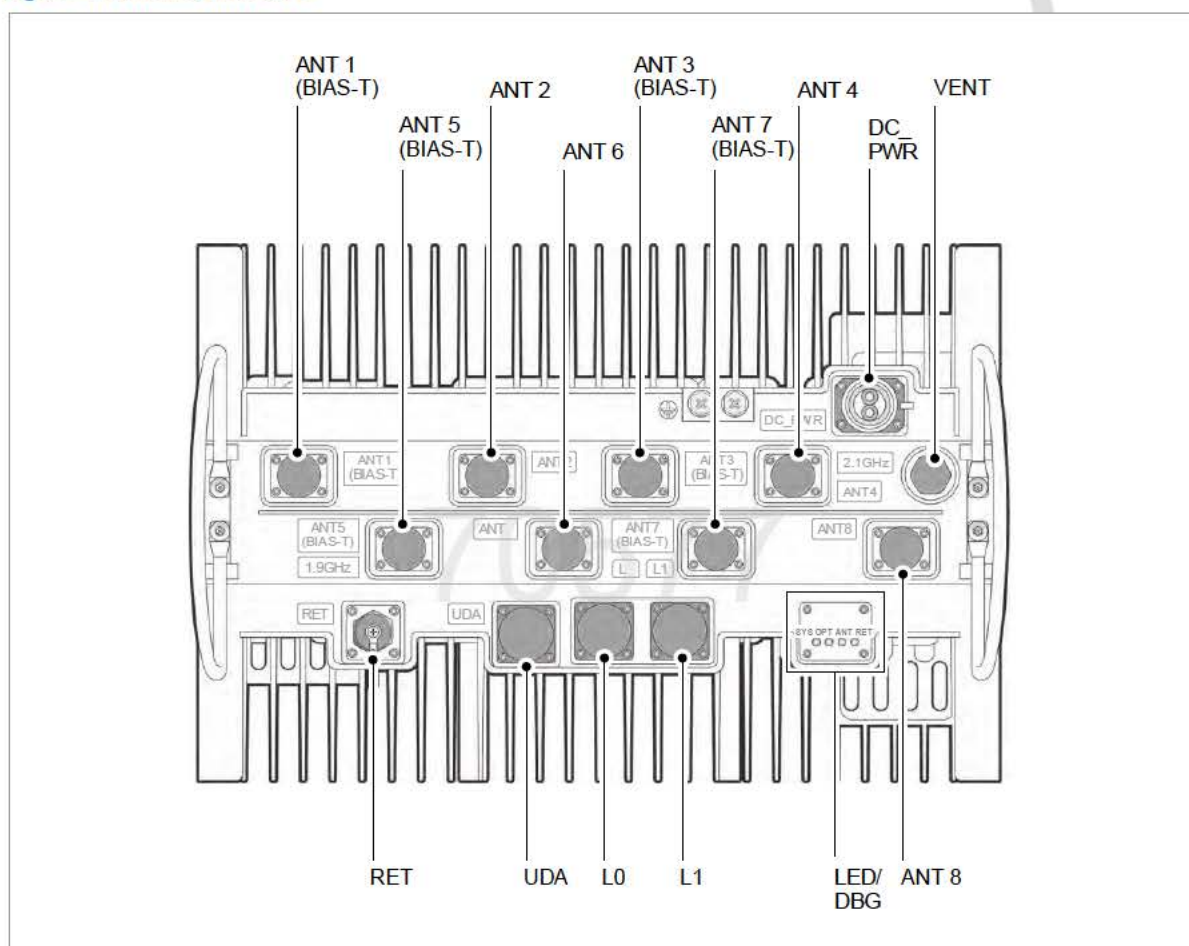
The power consumption is predicted with a simulation and the measured value is subject to change by $\pm 10\%$.

Chapter 3 External Interface

This chapter describes the LED information, and the port information of the RF4439d-25A.

The following figure depicts the external interface of the RF4439d-25A.

Figure 4. External Interface



LED Information

The LED displays the current status of RF4439d-25A as described in the following tables.

Table 3. RF4439d-25A SYS LED Information






Status	Description
	Green Blinking <ul style="list-style-type: none"> Normal condition No path has shut down by major alarm or disable alarm and at least one path works in normal operation. In multi-carrier case, at least one carrier in path works in normal operation.
	Green ON <ul style="list-style-type: none"> Standby condition No path has shut down by major alarm or disable alarm and no path works in normal operation. The RRU initialization is completed and ready to send the notification message to the DU.
	Red Blinking <ul style="list-style-type: none"> Imperfect condition due to the alarm At least one path has shut down by major alarm or disabled alarm and at least one path works in normal operation
	Red ON <ul style="list-style-type: none"> Abnormal condition due to the alarm At least one path has shut down by the major alarm or disabled alarm (Except for Voltage High/Low Major Alarm) and no path works in normal operation. The CPRI link is not set up. The RRU Initialization is in progress. (All paths are disabled.)
	OFF <ul style="list-style-type: none"> Shut down by Voltage High/Low Major Alarm

Table 4. RF4439d-25A OPT LED Information






Status	Description
	Green Blinking No Alarm, Normal condition
	Green ON No optical module insert
	Red Blinking Optic RX LOS or Optic Tx fault at one of the port
	Red ON Optic RX LOS or Optic Tx fault at all the ports
	OFF RRU input power off (No DC or AC input power)

Table 5. RF4439d-25A ANT LED Information












Status	Description
	Green Blinking No VSWR Alarm, Normal condition
	Green ON No RF output power (PA disable)
	Red Blinking VSWR Alarm occurs at one of the paths.
	Red ON VSWR Major Alarm (All paths)
	OFF RRU input power off (No DC or AC input power)

Table 6. RF4439d-25A RET LED Information

Status	Description	
	Green Blinking	When the RRU receives data by the RET.
	Green ON	<ul style="list-style-type: none"> RET power is OK. There is no RET data received for 180 s.  If RET is disconnected, the blinking green status can last for 180 s.
	Red Blinking	Reserved.
	Red ON	RET power fails.
	OFF	RRU input power off (No DC or AC input power).

Port Information

The following table outlines the port information of the RF4439d-25A.

Table 7. RF4439d-25A Port Information

Port Name	Connector Type	Description
RET	8-pin Circular	AISG interface
L0, L1,	Push pull, SFP+	CPRI optic connector used to connect to the DU 10Gbps fronthaul optic interface, 2 ports, 20 km <ul style="list-style-type: none"> Number marking: #0 - 1
DC_PWR	Push pull	-48 VDC (-38 to -57 VDC)
ANT_1 - 8	4.3-10 Plus female	TX/RX RF Antenna
UDA	Push pull, RJ45 type	User defined alarm (4 Rx)
LED	-	SYS, OPT, ANT, RET

Appendix Acronyms

ADC	Analog to Digital Converter
AISG	Antenna Interface Standard Group
CPRI	Common Public Radio Interface
DAC	Digital to Analog Converter
DU	Digital Unit
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
FITF	Field Installation Test Function
FPGA	Field Programmable Gate Array
LNA	Low Noise Amplifier
LSM	LTE System Manager
MMU	Massive MIMO Unit
RET	Remote Electrical Tilting
RF	Radio Frequency
RRU	Remote Radio Unit
RU	Radio Unit
SFP	Small Form Factor Pluggable
SMA	Sub Miniature Version A
UDA	User Defined Alarm

PRELIMINARY

102 RRU

Product Specification for RF4439d-25A

Document Version 1.0

© 2021 Samsung Electronics Co., Ltd.
All rights reserved.



MX06FHG865-HG

NWAV™ X-Pol Hex-Port Antenna

X-Pol Hex-Port 8 ft 65° Form in Tighter High Gain (FHG) with Smart Bias Ts, 698-2180 MHz:

2 ports 698-894 MHz and 4 ports 1695-2200 MHz

- Industry-leading high gain for MB and LB for extended cell coverage
- Excellent passive intermodulation (PIM) performance reduces harmful interference.
- Fully integrated (iRETs) with independent RET control for low and high bands for ease of network optimization
- Suitable for LTE/CDMA/PCS/UMTS/GSM air interface technologies
- Integrated Smart Bias-Ts reduce leasing costs
- Optimized width for reduced wind loading



NWAV

Electrical specification (minimum/maximum)	Ports 1, 2		Ports 3, 4, 5, 6		
Frequency bands, MHz	698-806	806-894	1695-1880	1850-1990	1920-2200
Polarization	± 45°		± 45°		
Max gain over all tilts, dBi	17.2	17.6	19.4	19.5	20.0
Average gain, dBi	17.1 ± 0.1	17.3 ± 0.3	19.3 ± 0.1	19.2 ± 0.3	19.7 ± 0.3
Horizontal beamwidth (HBW), degrees	67.0	65.0	63.0	63.0	62.0
Front-to-back ratio, co-polar power @180°± 30°, dB	>25.0	>25.0	>28.0	>26.0	>25.0
X-Pol discrimination (CPR) at boresight, dB	>20.0	>18.0	>25	>20	>18
Sector power ratio, percent ¹	<4.0	<3.6	<5.0	<3.8	<3.6
Vertical beamwidth (VBW), degrees ¹	9.3	8.4	5.0	4.9	4.5
Electrical downtilt (EDT) range, degrees	0-10		0-7		
First upper side lobe (USLS) suppression, dB ¹	≤-16.0	≤-15.0	≤-16.0	≤-16.0	≤-16.0
Cross-polar isolation, port-to-port, dB ¹	25	25	25	25	25
Max VSWR / return loss, dB	1.5:1 / -14.0		1.5:1 / -14.0		
Max passive intermodulation (PIM), 2x20W carrier, dBc	-153		-153		
Max input power per any port, watts	300		250		
Total composite power all ports, watts	1500				

¹ Typical value over frequency and tilt



MX06FHG865-HG

NWAV™ X-Pol Hex-Port Antenna

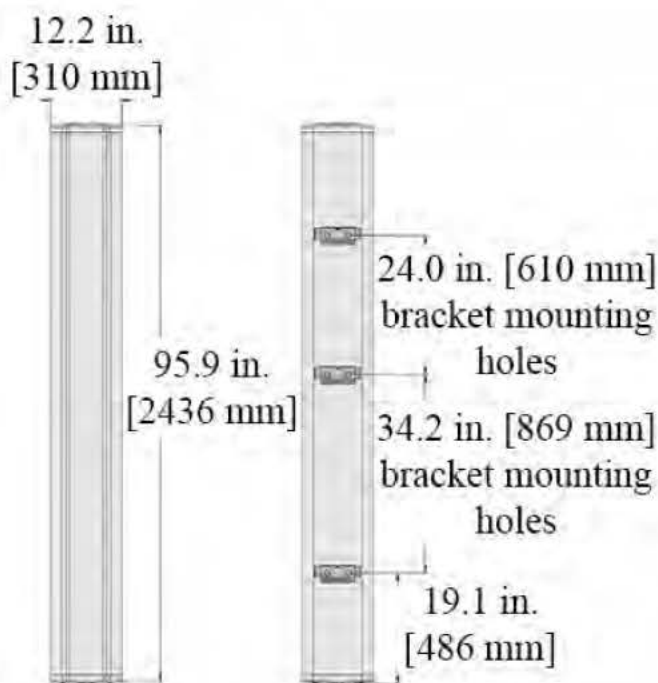
Mechanical specifications

Dimensions height/width/depth, inches (mm)	95.9/ 12.2/ 7.5 (2436/ 310/ 191)
Shipping dimensions length/width/height, inches (mm)	106/ 20/ 15 (2692/ 508/ 381)
No. of RF input ports, connector type, and location	6 x 4.3-10 female, bottom
RF connector torque	96 lbf-in (10.85 N·m or 8 lbf-ft)
Net antenna weight, lb (kg)	51 (23.1)
Shipping weight, lb (kg)	100 (45.3)
Antenna mounting and downtilt kit included with antenna	91900318, 91900319 (middle bracket)
Net weight of the mounting and downtilt kit, lb (kg)	26 (11.82)
Range of mechanical up/down tilt	-2° to 12°
Rated wind survival speed, mph (km/h)	150 (241)
Frontal and lateral wind loading @ 150 km/h, lbf (N)	90.5 (402.6), 81.2 (361.2)
Equivalent flat plate @ 100 mph and Cd=2, sq ft	2.27
EPA frontal and lateral, ft², (m²)	4.1 (0.38), 2.2 (0.20)

Front view

Back view

Bottom view



Ordering information

Antenna model	Description
MX06FHG865-HG	8F X-Pol HEX FHG 65°, 0-10° / 0-7° RET, 4.3-10 & SBT
Optional accessories	
AISG cables	M/F cables for AISG connections
PCU-1000 RET controller	Stand-alone controller for RET control and configurations

Remote electrical tilt (RET 1000) information

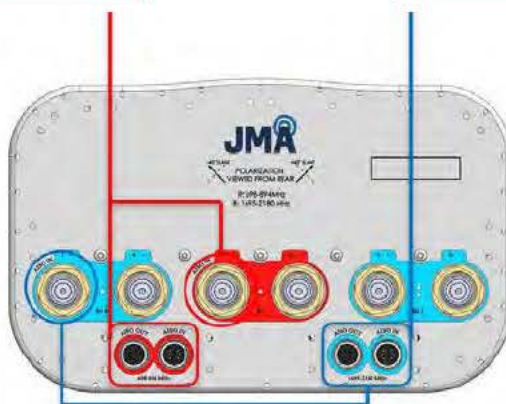
RET location	Integrated into antenna
RET interface connector type	8-pin AISG connector per IEC 60130-9
RET connector torque	Min 0.5 N·m to max 1.0 N·m (hand pressure & finger tight)
RET interface connector quantity	2 pairs of AISG male/female connectors
RET interface connector location	Bottom of the antenna
Total no. of internal RETs (low bands)	1
Total no. of internal RETs (high bands)	1
RET input operating voltage, vdc	10-30
RET max power consumption, idle state, W	≤ 2.0
RET max power consumption, normal operating conditions, W	≤ 13.0
RET communication protocol	AISG 2.0 / 3GPP

RET and RF connector topology

Each RET device can be controlled either via the designated external AISG connector or RF port as shown below:

RET device	Band	RF port
R1	698-894	1-2

RET device	Band	RF port
B1/B2	1695-2200	3-6



Array topology

3 sets of radiating arrays

R1: 698-894 MHz
B1: 1695-2200 MHz
B2: 1695-2200 MHz

Band	RF port
1695-2200	3-4
698-894	1-2
1695-2200	5-6



700/850 4T4R Macro 320W ORU - New Filter (RF4461d-13A)

SAMSUNG

Specifications



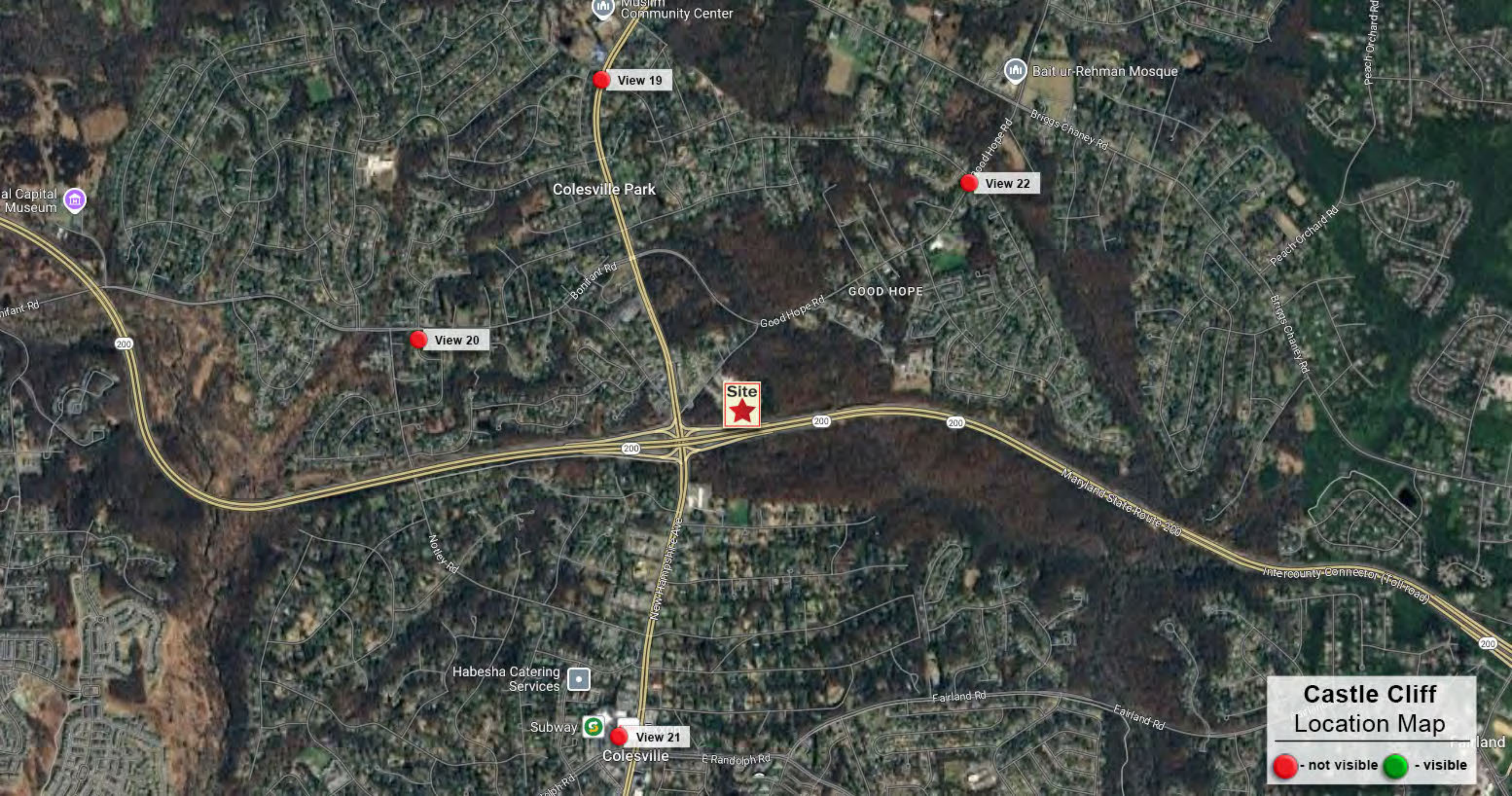
* 5MHz supporting in B13(700MHz) depends on 3GPP std. and UE capability.
External filters in interferer and victim sides for Mexican boarder to support 5MHz service need to be considered
** Finger guard is not needed.

Item	Specification	
Air Interface	LTE, NR(HW resource ready)	
Band	Band13 (700MHz)	Band5 (850MHz)
Frequency	DL: 746~756MHz	DL: 869~894MHz
	UL: 777~787MHz	UL: 824~849MHz
1BW	10MHz	25MHz
0BW	10MHz	25MHz
Carrier Bandwidth	LTE/NR 5*/10MHz	LTE 5/10MHz NR 5/10/15/20MHz
# of carriers	2C*	3C
Total # of carriers	4C + B13 (SDL) 1C	
RF Chain	4T4R/2T4R/2T2R/1T2R	
	2T2R+2T2R bi-sector	
RF Output Power	Total : 320W	
	4 x 40W or 2 x 60W	4 x 40W or 2 x 60W
Spectrum Analyzer	TX/RX Support	
RX Sensitivity	Typ. -104.5dBm @1Rx (25RBs 5MHz)	
Modulation	256QAM support, (1024QAM with 1~2dB power back-off)	
Input Power	-48VDC (-38VDC to -57VDC)	
Power Consumption	1,165 Watt @ 100% RF load, room temperature	
Size (WHD)	380 x 380 x 260 mm (14.96 x 14.96 x 10.23 inch)	
Volume	37.5 L	
Weight (W/o Solar Shield & finger guard)	35.9 kg (79.1 lb)	
Operating Temperature	-40°C (-40°F) ~ 55°C (131°F) (Without solar load)	
Cooling	Natural convection	
Unwanted Emission	3GPP 36.104	3GPP 36.104
	FCC 47 CFR 27.53 c), f)	FCC 47 CFR 22.917
	-	-69 dBm/100 kHz per path @ 896 ~901MHz
CPRI Cascade	Not supported	
Optic Interface	20km, 2 ports (9.8Gbps x 2), SFP+, single mode, Duplex (Option: Bi-di)	
RET & TMA Interface	AISG 3.0	
Bias-T	4 ports (2 ports per band)	
Mounting Options	Pole, wall	
NB-IoT	2GB+21B or 41B	2SA+2GB or 2GB+21B or 4GB
PIM Cancellation	Support	
# of antenna port	4	
External Alarm	4	
Fronthaul Interface	Opt. 8 CPRI / Opt. 7-2x selectable (not simultaneous support)	
CPRI compression	Not Support	



Castle Cliff Location Map

- - not visible
- - visible



Muslim Community Center

View 19

Bait ur-Rehman Mosque

View 22

Colesville Park

al Capital Museum

View 20

Site

GOOD HOPE

200

200

200

Maryland State Route 200

Intercounty Connector (Toll road)

Habesha Catering Services

Subway

View 21

Colesville

E Randolph Rd

Fairland Rd

Fairland Rd

Castle Cliff Location Map

● - not visible ● - visible



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 6-MD Route 200
View from the Southeast
Located .10 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 7-New Hampshire Avenue
View from the Northwest
Located .25 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 8-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 9-Cape May Road
View from the West
Located .16 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 10-Bonifant Road &
New Hampshire Avenue
View from the Northwest
Located .52 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 11-Good Hope Road &
Cape May Road
View from the North
Located .24 miles from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 12-Good Hope Road
View from the Northeast
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 13-New Hampshire Avenue
View from the Northeast
Located .41 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 14-Amberleigh Drive
View from the West
Located .48 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 15-Amberleigh Drive
View from the West
Located .37 miles from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 16-Colesville Manor Drive
View from the Southwest
Located .43 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 17-Hobbs Drive
View from the Southwest
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 18-Hobbs Drive
View from the South
Located .34 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 19-New Hampshire Avenue &
Southview Avenue
View from the Northwest
Located 1 mile from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 20-Sandy Ridge Road
View from the West
Located .93 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

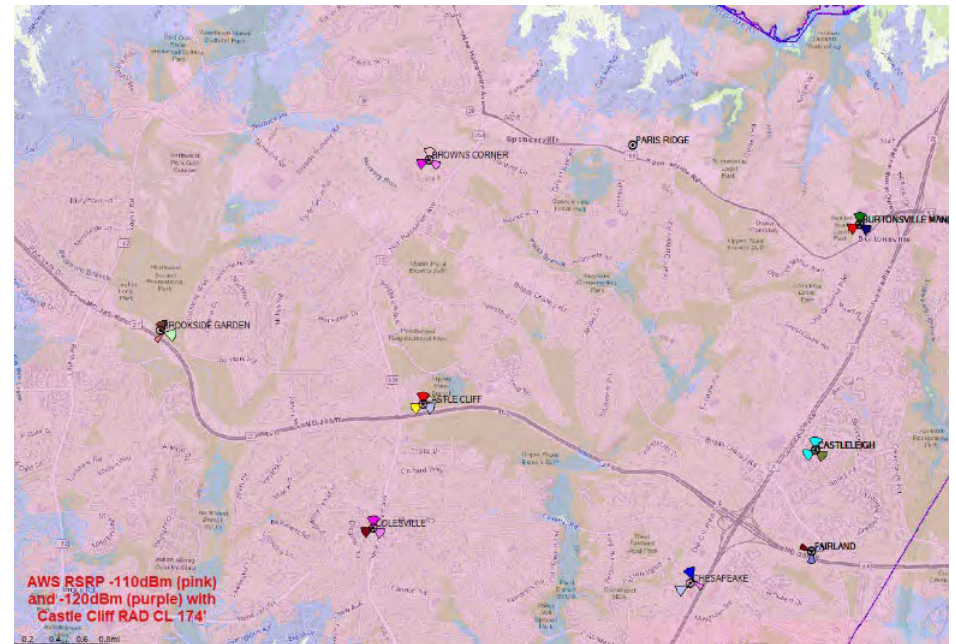
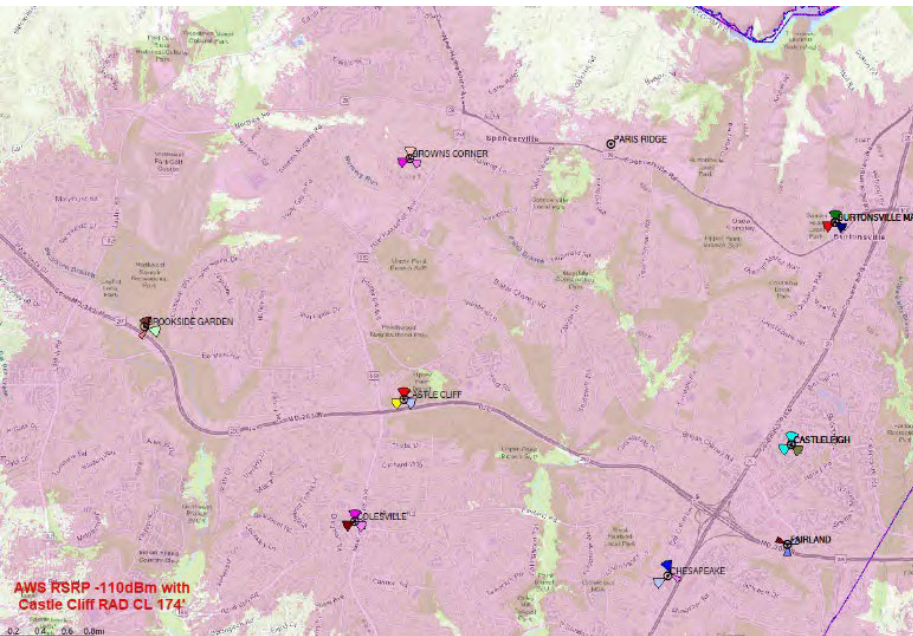
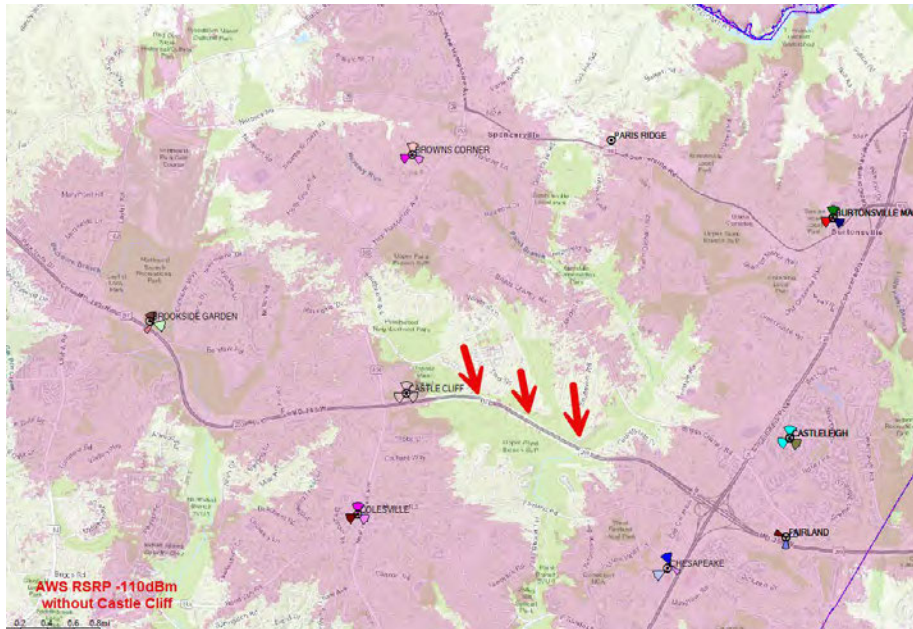
Photograph Information:
View 21-Colesville Shopping Center
View from the Southwest
Located 1 mile from Tower Site
SITE NOT VISIBLE

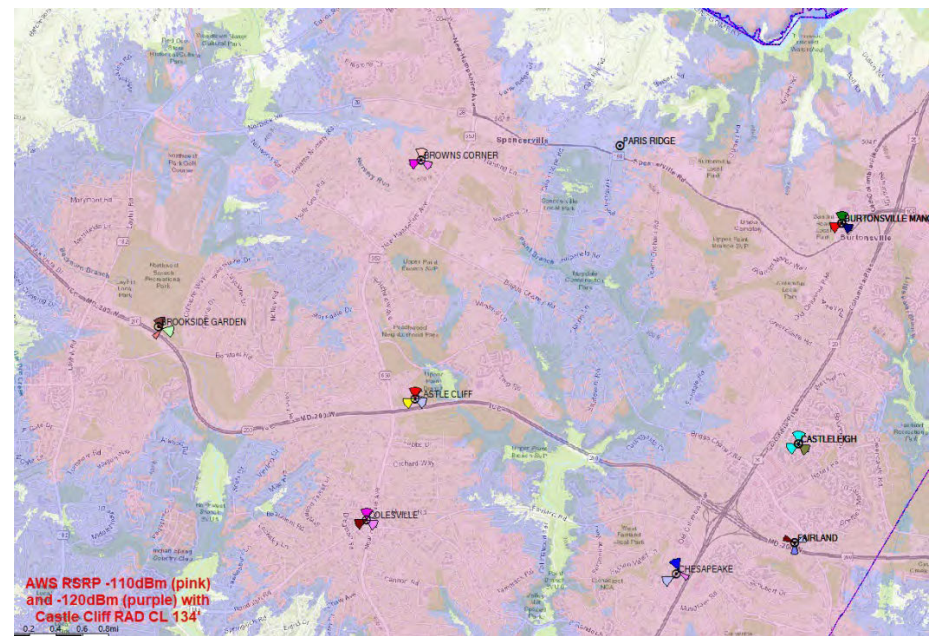
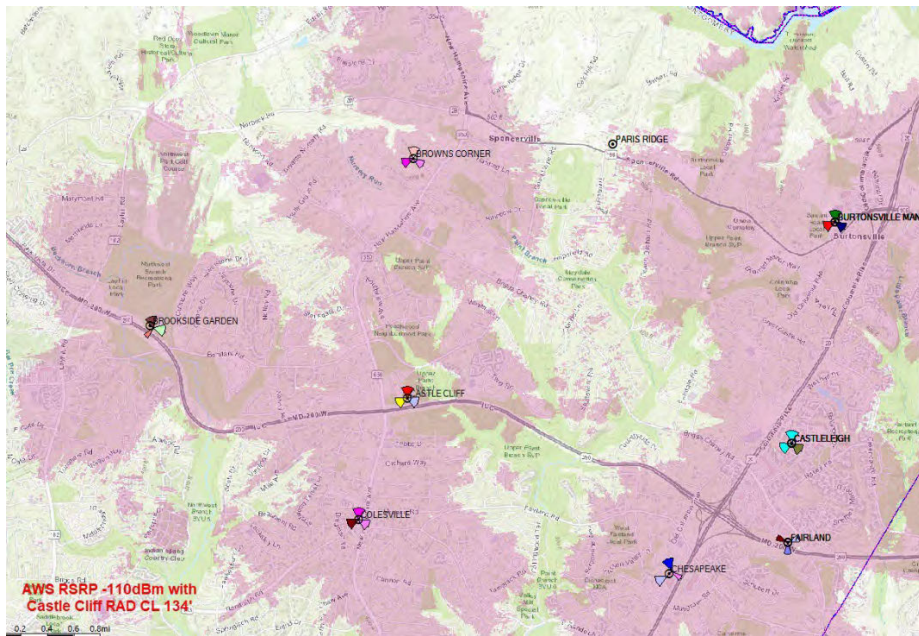
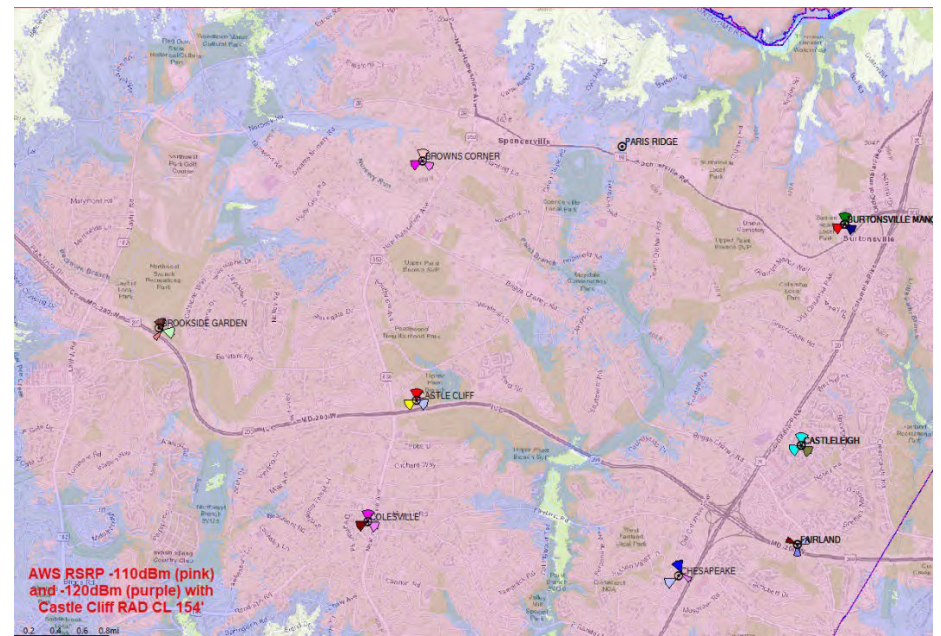
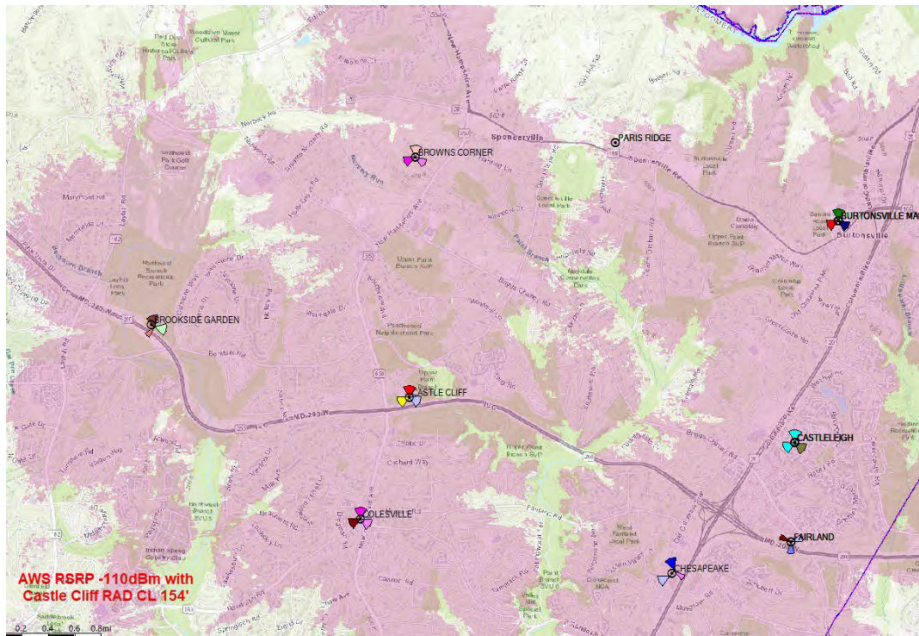


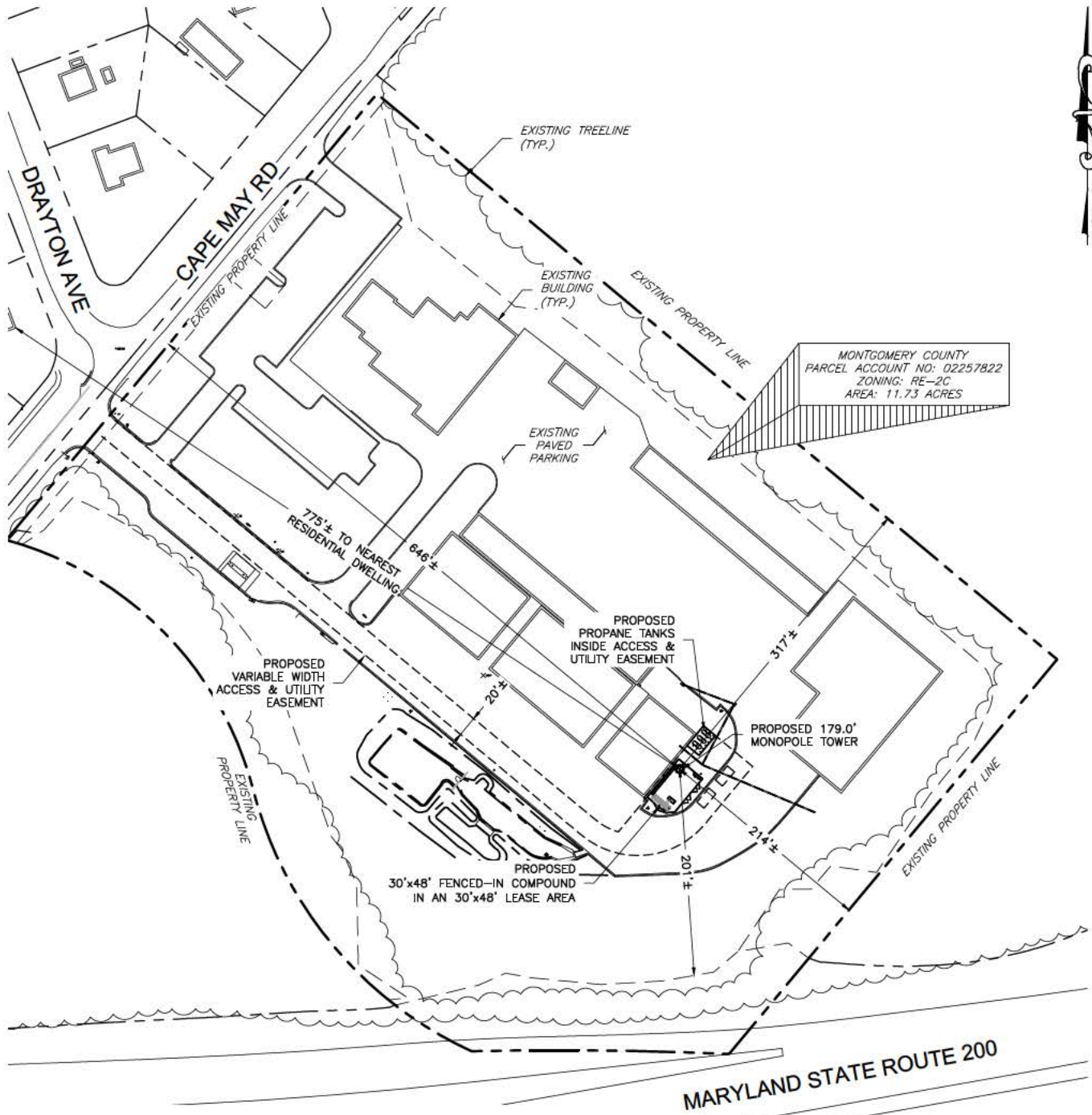
Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 22-Good Hope Road &
Windmill Lane
View from the Northeast
Located .90 miles from Tower Site
SITE NOT VISIBLE









PROPERTY INFORMATION

OWNER: MONTGOMERY COUNTY
OWNER ADDRESS: EOB 101 MONROE ST
ROCKVILLE, MD 20850
PARCEL ID: 02257822
ZONING: RE-2C
AREA: 11.73 ACRES

PROPERTY PLAN



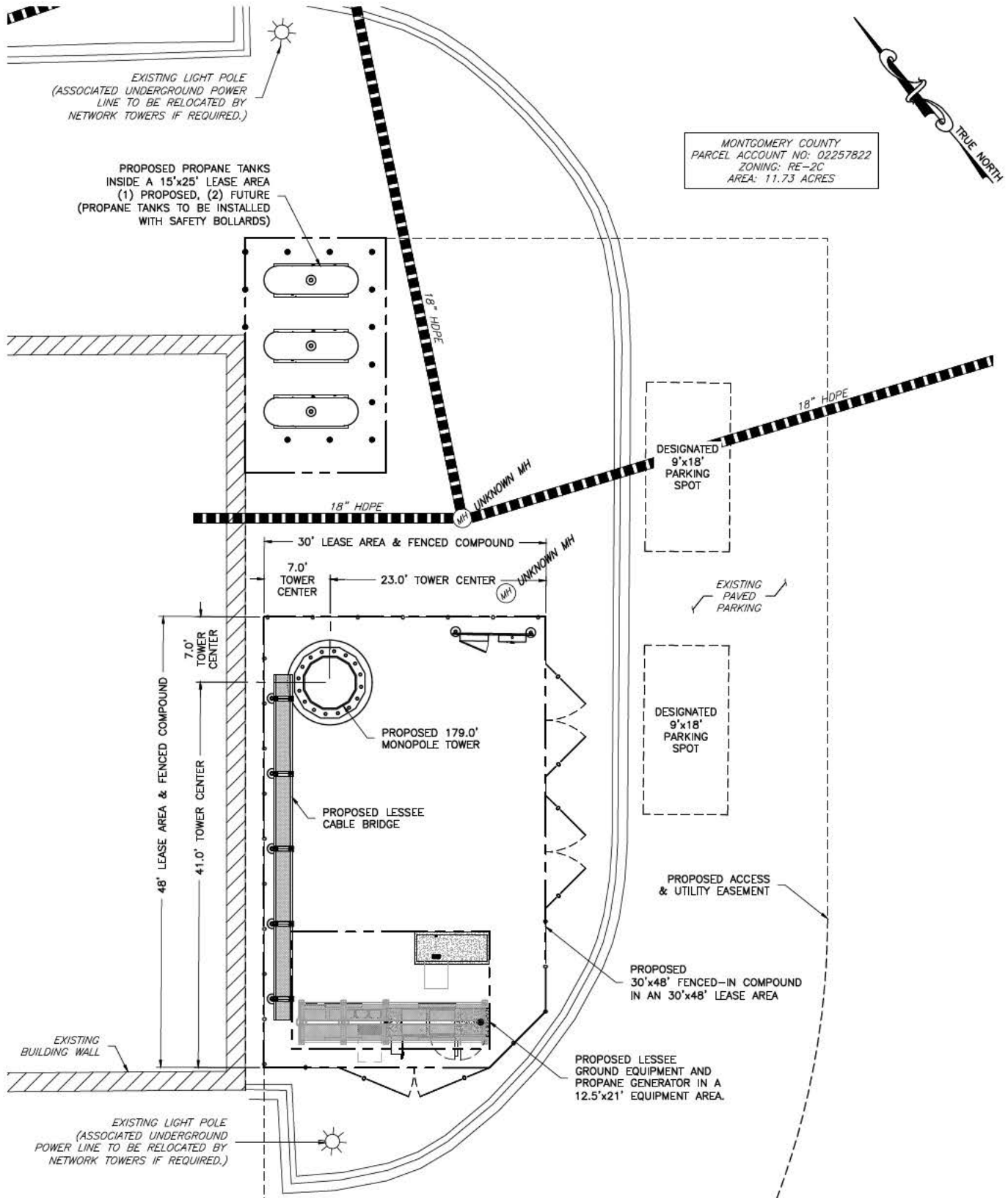
"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -
LAT (NAD 83): 39.0897°
LONG (NAD 83): -76.9962°

SHEET 1

01/23/2025
BY: OP



COMPOUND PLAN



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

SHEET 2

01/23/2025
BY: OP

PROPOSED LESSEE ANTENNAS
(2) JMA WIRELESS MX06FHG865-HG PER SECTOR, (6) TOTAL
(1) SAMSUNG MT6413-77A PER SECTOR, (3) TOTAL

LESSEE TOWER SPACE
179' AGL TO 167' AGL

FUTURE EQUIPMENT ANTENNAS

PROPOSED
179' MONOPOLE

PROPOSED TOP OF MONOPOLE
ELEV.= 179.0' AGL

PROPOSED CARRIER ANTENNA RAD CENTER
ELEV.= 174.0' AGL

FUTURE CARRIER ANTENNA RAD CENTER
ELEV.= 162.0' AGL

FUTURE CARRIER ANTENNA RAD CENTER
ELEV.= 152.0' AGL

PROPOSED
FENCED COMPOUND

EXISTING GRADE
ELEV.= 0.0' AGL

ELEVATION



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

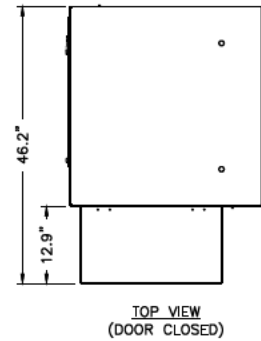
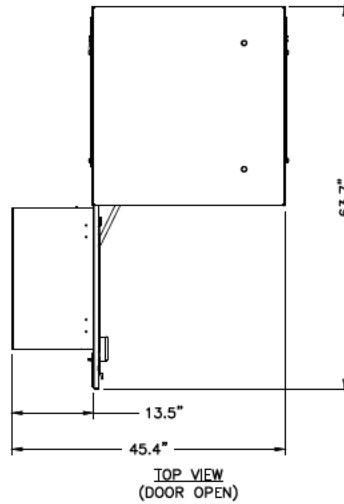
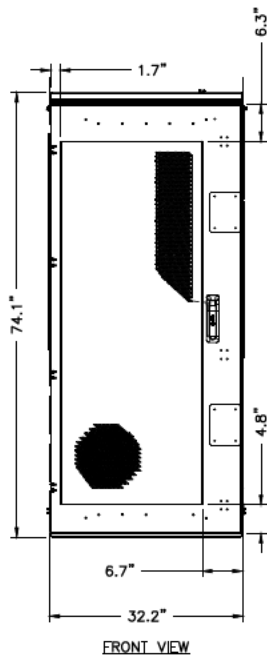
SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

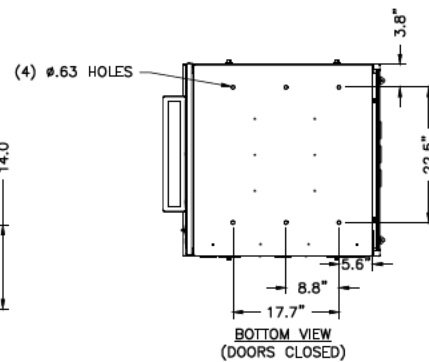
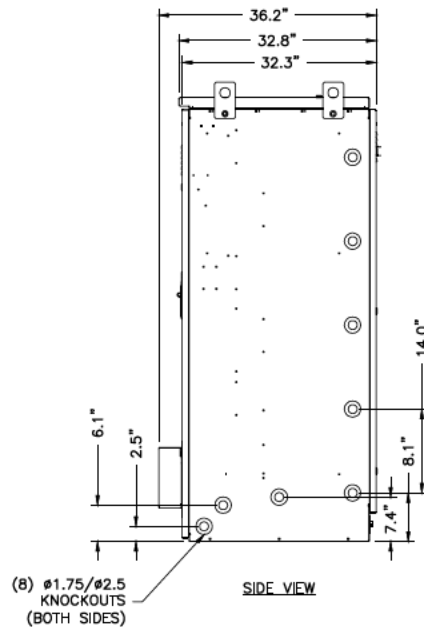
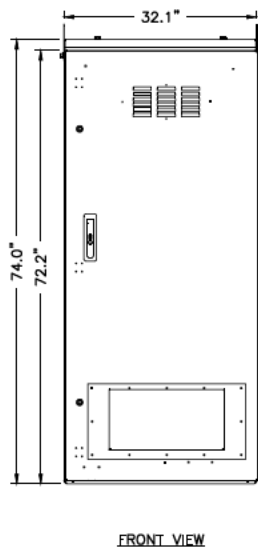
SHEET 3

**01/23/2025
BY: OP**



SPECIFICATIONS:
 HEIGHT: 74.1"
 WIDTH: 32.2"
 DEPTH: 46.2"
 WEIGHT: 450 LBS (EMPTY)

1 **CHARLES CABINET CUBE-PM63912TN1 DETAIL**
 NOT TO SCALE



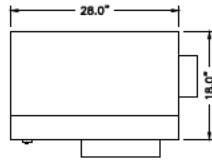
SPECIFICATIONS:
 HEIGHT: 74.1"
 WIDTH: 32.1"
 DEPTH: 36.2"
 WEIGHT: 900 LBS (EMPTY)

2 **CHARLES LT-BB24/BB48 BATTERY CABINET**
 NOT TO SCALE



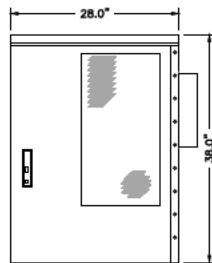
"CASTLE CLIFF"
 (911 ADDRESS TBD)
 14335 CAPE MAY RD.
 SILVER SPRING, MD 20904
 MONTGOMERY COUNTY

SITE INFORMATION	
SITE VISIT BY: -	DATE: -
LAT (NAD 83): 39.0897°	
LONG (NAD 83): -76.9962°	
SHEET 4	01/23/2025 BY: OP

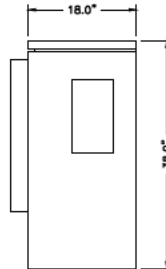


TOP VIEW

SPECIFICATIONS
 MANUFACTURER: CHARLES INDUSTRIES
 HEIGHT: 38.0 IN
 WIDTH: 28.0 IN
 DEPTH: 18.0 IN

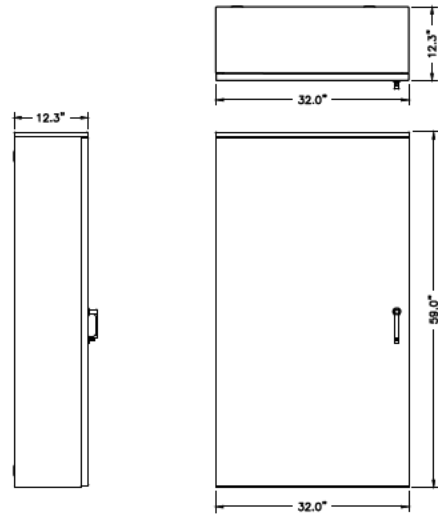


FRONT VIEW

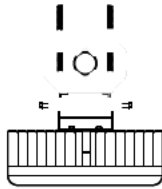


SIDE VIEW

4 CHARLES CUBE DETAIL
 C-4 NTS



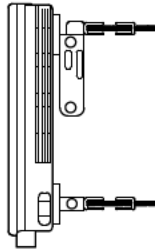
3 ASCO D300L INTEGRATED LOAD CENTER
 C-4 NTS



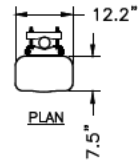
TOP VIEW



FRONT VIEW

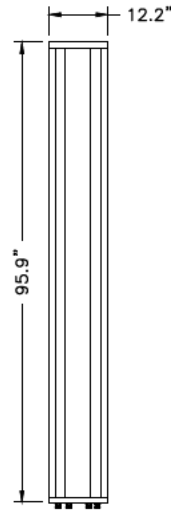


SIDE VIEW

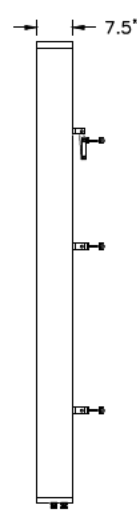


PLAN

ANTENNA WEIGHT:
51.0 LBS



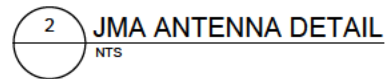
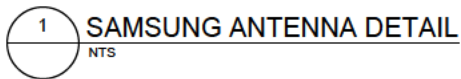
ELEVATION



SIDE

MODEL #	HEIGHT	WIDTH	DEPTH	WEIGHT W/O BRACKET
MT6413-77A	28.9"	15.8"	5.51"	57.32 LBS

MODEL #	HEIGHT	WIDTH	DEPTH	WEIGHT W/O BRACKET
MX06FHG865-HG	95.9"	12.2"	7.5"	51.0 LBS



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

SHEET 6

01/23/2025
BY: OP

MILLENNIUM ENGINEERING, P.C.

42 Old Barn Drive
West Chester, Pennsylvania 19382

Cell: 610-220-3820
www.millenniumeng.com

Email: pauldugan@comcast.net

January 29, 2025

Attn: Jim Golden, Director- Strategic Programs
Network Towers II, LLC
6095 Marshalee Drive, Suite 300
Elkridge, MD 21075

Re: RF Safety FCC Compliance of Proposed Communications Facility

Site Name: Castle Cliff, Proposed 179' Monopole

Site Address: 14335 Cape May Road, Silver Spring, MD 20904 (Montgomery County)

Latitude 39° 05' 23.388" N, Longitude 76° 59' 46.482" W (NAD83), G.E. 454' +/- A.M.S.L.

Dear Mr. Golden,

I have performed an analysis to provide an independent determination and certification that the proposed Verizon Wireless communications facility at the above referenced property will comply with Federal Communications Commission (FCC) exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields (Code of Federal Regulation 47 CFR 1.1307 and 1.1310). As a registered professional engineer, I am under the jurisdiction of the State Registration Boards in which I am licensed to hold paramount the safety, health, and welfare of the public and to issue all public statements in an objective and truthful manner.

The proposed communications facility consists of a new 179' monopole at the above referenced property. The proposed antenna configuration consists of 9 total antennas (3 per sector) as follows:

- (6) multiband directional panel antennas (JMA Wireless MX06FHG865-HG or equivalent), (2) per sector at a centerline of 174 ft, azimuth of 5-115-240; transmitting from these antennas will be (1) 700 MHz LTE wideband channel, (1) 850 MHz LTE & 5G wideband channel, (1) 1900 MHz LTE wideband channel, (1) AWS 2100 MHz LTE wideband channel, and (2) AWS3 2100 MHz LTE wideband channels
- (3) LS6 5G panel antennas (Samsung MT6413-77A or equivalent), (1) per sector at a centerline of 174; azimuth of 5-115-240; transmitting from these antennas will be (1) LS6 3700 MHz (TX 3700-3860; RX 3700-3860) 5G wideband channel

The following assumptions are made for reasonable upper limit radiofrequency operating parameters for the proposed facility due to the Verizon Wireless antennas alone:

- (2) 700/850/1900/2100 MHz (LTE) multiband directional transmit antennas per sector
- (1) 3700 MHz 5G directional transmit antenna per sector
- (1) 700 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 850 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 1900 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain

- (1) 2100 MHz LTE AWS wideband channel at 4X40W max power/face before cable loss/antenna gain
- (2) 2100 MHz LTE AWS3 wideband channels at 4x40W max power/face before cable loss/antenna gain
- (1) 3700 MHz 5G wideband channel at 320W max power/face before cable loss/antenna gain
- The facility would be at or near full capacity during busy hour

ERP Calculation

700: 4X40W = 160W = 52 dBm + 17.1 dB = 69.1 dBm = 8128W ERP

850: 4X40W = 160W = 52 dBm + 17.3 dB = 69.3 dBm = 8511W ERP

1900: 4X40W = 160W = 52 dBm + 19.2 dB = 71.2 dBm = 13183W ERP

2100: 4X40W = 160W = 52 dBm + 19.7 dB = 71.7 dBm = 14791W ERP

3700: 8X40W = 320W = 55 dBm + 19.9 dB = 74.9 dBm = 30903W ERP

Note: the above ERP calculation is total ERP across each entire band and does not break down into W/MHz

Using the far-field power density equations from FCC Bulletin OET 65, the power density at any given distance from the antennas is equal to $0.360(ERP)/R^2$ where R is the distance to the point at which the exposure is being calculated. The given equation is a conversion of the OET 65 power density equation for calculating power density given the distance in feet and the result in metric units (mW/cm^2). This calculated power density assumes the location is in the main beam of the vertical pattern of the antenna. After making an adjustment for the reduction in power density due to the vertical pattern of the transmit antenna, the calculated ground level power density is well below 1 % of the FCC general population exposure limit at any distance from the antenna system of Verizon Wireless.

The 700 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $500 \mu W/cm^2$ or $0.5 mW/cm^2$. The 850 MHz transmit frequencies, which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $587 \mu W/cm^2$ or $0.587 mW/cm^2$. The 1900 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 2100 MHz which Verizon Wireless is also licensed by the FCC to operate, have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 3700 MHz C-Band transmit frequencies have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$.

Therefore, the exposure at ground level at any distance from the structure would be substantially below 1 % of the FCC general population exposure limits due to Verizon Wireless antennas alone. The extremely low ground exposure levels are due to the elevated positions of the antennas in the structure and the low power which these systems operate. See Figures 1 and 2 in back of this report which discusses the relationship between height, proximity or distance, and orientation to level of electromagnetic field exposure.

In summary, the proposed communications facility will comply with all applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65). Federal law (FCC Rule Title 47 CFR 1.1307 and 1.1310) sets the national standard for compliance with electromagnetic field safety. The FCC exposure limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) and, over a wide range of frequencies, the exposure limits developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI). **Thus, there is full compliance with the standards of the IRPA, FCC, IEEE, ANSI, and NCRP.**

General Information on Electromagnetic Field Safety

Verizon Wireless facilities transmit and receive low power electromagnetic fields (EMF) between base station antennas and handheld devices (smart phones, ipads, laptops, jetpacks, etc.). The radiofrequency energy from these facilities and devices is non-ionizing electromagnetic energy. Non-ionizing, unlike X-Rays or other forms of potentially harmful energy in the microwave region, is not cumulative over time nor can the energy change the

chemical makeup of atoms (e.g. strip electrons from ions). “Non-ionizing” simply means that the energy is not strong enough to break ionic bonds.

Safe levels of electromagnetic fields were determined by numerous worldwide organizations, such the International Committee for Non-Ionizing Radiation Protection, a worldwide multi-disciplinary team of researchers and scientists studying the effects of non-ionizing radiofrequency energy such as that emitted by base stations or cell phones. The FCC did not arbitrarily establish their own standards, but rather adopted the recommendations of all leading organizations that set standards and research the subject such as the Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), and National Council on Radiation Protection and Measurements (NCRP).

When Verizon Wireless, or any commercial wireless communications licensee, is located on an antenna structure such as a self-supporting lattice type tower, monopole, guyed tower, watertank, etc. the antennas are typically 10 meters or more above ground level (10 meters = 32.81 feet). With the relatively low power and elevated positions of the antennas on the structure with respect to ground level, the maximum ground level exposure can rarely approach 1 % of the applicable FCC exposure limit regardless of how many sets of antennas are collocated on the structure. For this reason, the FCC considers the facilities “categorically excluded” from routine evaluation at antenna heights above 10 meters (or above 32.81 feet). Categorical exclusion exempts a site from routine on-site evaluation. However, the facility is not excluded from compliance with the federal exposure limits and guidelines. The types of facilities used by Verizon Wireless typically elevated on antenna structures (away from access to close proximity, i.e. greater than 10 meters or 32.81 feet) simply cannot generate ground level exposure levels that approach the limits under any circumstances.

From a regulatory perspective, the FCC has sole jurisdiction over the regulation of electromagnetic fields from all facilities and devices. The FCC has established guidelines and limits over emissions and exposure to protect the general public. The FCC also has certain criteria that trigger when an environmental evaluation must be performed. The criteria are based on distance from the antennas (accessibility) and transmit power levels.

CONCLUSIONS:

- 1) The proposed Verizon Wireless communications facility will comply with electromagnetic field safety standards by a substantial margin (well below 1 %) in all publicly accessible areas. This includes the base of the proposed structure and any areas in proximity to the structure.**
- 2) Verizon Wireless takes appropriate measures to ensure that all telecommunications facilities (including this proposed facility) comply with applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65).**
- 3) In cases where such compliance exists, the subject of electromagnetic field safety is preempted.** The Telecommunications Act of 1996 states that: “No state or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [FCC’s] regulations concerning such emissions.” Telecommunications Act of 1996, § 332[c][7][B][iv].

Respectfully,



Paul Dugan, P.E.
Registered Professional Engineer
Maryland License Number 24211

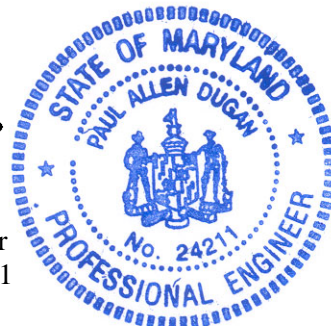
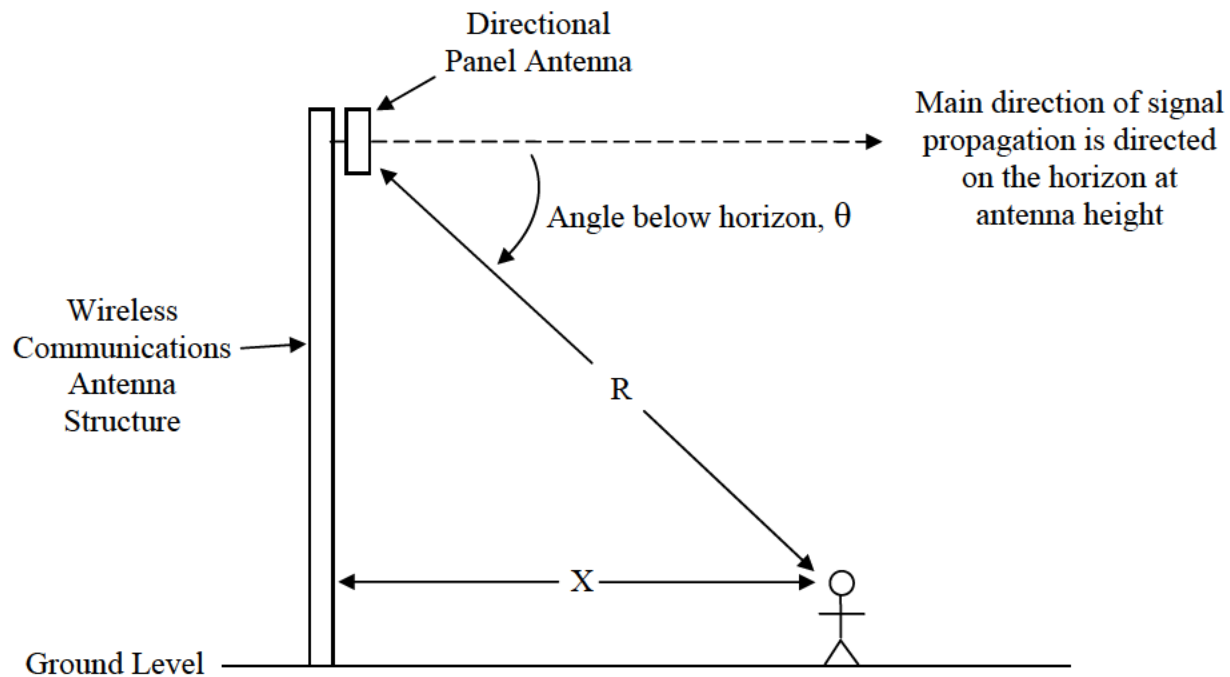
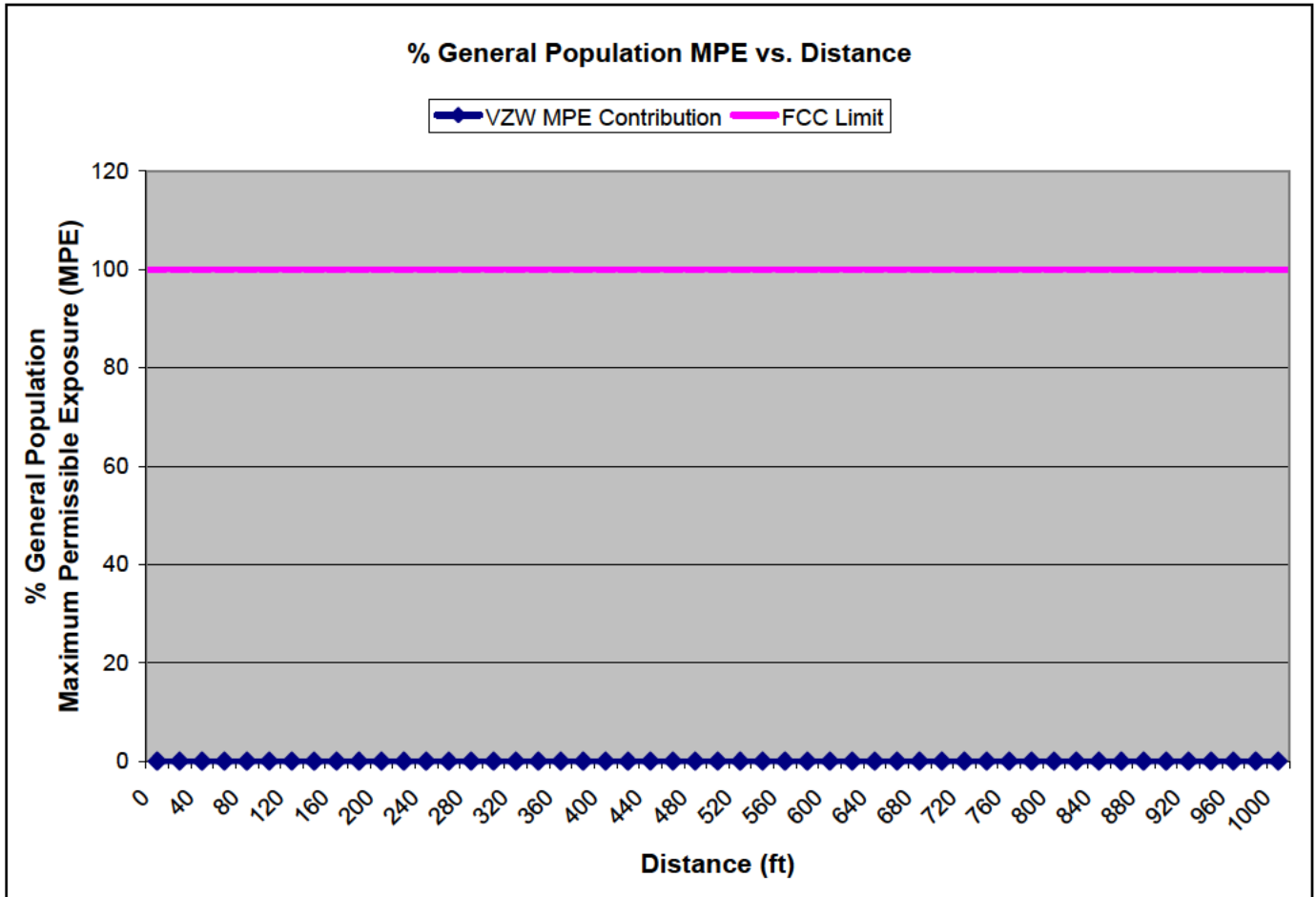


FIGURE 1: Diagram of Electromagnetic Field Strength as a Function of Distance and Antenna Orientation



The above diagram illustrates the conceptual relationship of distance and orientation to directional panel antennas used in wireless communications. At the base of the structure ($x = 0$), the distance R is a minimum when the angle of the direction of propagation θ is a maximum. As one moves away from the antenna structure, the horizontal distance X increases as well as the distance R to the antennas while the angle below the horizon decreases. For this reason, electromagnetic fields from these facilities remain fairly uniform up to a few hundred feet and continue to taper off with distance. As noted in the report, the electromagnetic fields from these types of facilities are hundreds of times below safety standards at any distance from the antenna structure, making them essentially indistinguishable relative to other sources of electromagnetic fields in the environment due to the elevated heights of the antennas and the relatively low power at which these systems operate.

FIGURE 2: Graph of MPE Contribution vs. Distance



The above graph represents the contribution of VZW to the composite electromagnetic field exposure level at any distance from the base of the structure. The contribution of VZW will remain well under 1% of the FCC general population maximum permissible exposure (MPE) at any distance as shown.

DECLARATION OF ENGINEER

Paul Dugan, P.E., declares and states that he is a graduate telecommunications consulting engineer (BSE/ME Widener University 1984/1988), whose qualifications are a matter of record with the Federal Communications Commission (FCC). His firm, Millennium Engineering, P.C., has been retained by Network Towers II LCC to perform power density measurements or calculations for an existing or proposed communications facility and analyze the data for compliance with FCC exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields.

Mr. Dugan also states that the calculations or measurements made in the evaluation were made by himself or his technical associates under his direct supervision, and the summary letter certification of FCC compliance associated with the foregoing document was made or prepared by him personally. Mr. Dugan is a registered professional engineer in the Jurisdictions of Pennsylvania, New Jersey, Delaware, Maryland, Virginia, New York, Connecticut, District of Columbia, West Virginia, Puerto Rico, and Colorado with 40 years of engineering experience. Mr. Dugan is also an active member of the Association of Federal Communications Consulting Engineers, the National Council of Examiners for Engineering, the National Society of Professionals Engineers, the Pennsylvania Society of Professional Engineers, and the Radio Club of America. Mr. Dugan further states that all facts and statements contained herein are true and accurate to the best of his own knowledge, except where stated to be in information or belief, and, as to those facts, he believes them to be true. He believes under penalty of perjury the foregoing is true and correct.


Paul Dugan, P.E.

Executed this the 29th day of January, 2025.

PAUL DUGAN, P.E.
42 Old Barn Drive
West Chester, PA 19382
Cell: 610-220-3820
Email: paul.mepc@gmail.com
Web Page: www.millenniumeng.com

EDUCATION: Widener University, Chester, Pennsylvania
Master of Business Administration, July 1991
Master of Electrical Engineering, December 1988
Bachelor of Science, Electrical Engineering, May 1984

PROFESSIONAL ASSOCIATIONS: **Registered Professional Engineer** in the following jurisdictions:

Pennsylvania, License Number PE-045711-E
New Jersey, License Number GE41731
Maryland, License Number 24211
Delaware, License Number 11797
Virginia, License Number 36239
West Virginia, License Number 20258
Connecticut, License Number 22566
New York, License Number 079144
District of Columbia, License Number PE-900355
Puerto Rico, License Number 18946
Colorado, License Number PE.0065295

Full member of **The Association of Federal Communications Consulting Engineers**
(www.afcce.org) January 1999 to Present

Elected and served on the Board of Directors for five year term 2006-2011

Full member of **The National Society of Professional Engineers** (www.nspe.org) and the **Pennsylvania Society of Professional Engineers** (www.pspe.org) June 2003 to Present
Currently serving as PSPE State Director and Past President on the Board of Directors of the Valley Forge Chapter and the South East Region Vice-Chair for the "Professional Engineers in Private Practice" Executive Committee. Actively participated in NSPE Annual Conferences 7/2005 to Present.

Actively participate in **Chester County ARES/RACES Amateur Radio** (CCAR www.w3eoc.org) which prepares and provides emergency backup communications for Chester County Department of Emergency Services, March 2005 to Present

Full member of **The National Council of Examiners for Engineering**
(www.ncees.org) May 2001 to Present

Full Member of **The Radio Club of America**
(www.radio-club-of-america.org) December 2003 to Present

Pennsylvania Real Estate License Number RS347405 Keller Williams 2/2019 to Present

PROFESSIONAL EXPERIENCE: Millennium Engineering, P.C., West Chester, Pennsylvania
Position: **President**, August 1999 to Present (www.millenniumeng.com)

Verizon Wireless, Plymouth Meeting, Pennsylvania
Position: **Cellular RF System Design/Performance Engineer**, April 1990 to August 1999

Communications Test Design, Inc., West Chester, Pennsylvania
Position: **Electrical Engineer**, May 1984 to April 1990

PERSONAL: Date/place of birth: November 21, 1961, West Chester, Pennsylvania; United States Citizen



DEPARTMENT OF GENERAL SERVICES

Marc Elrich
County Executive

David Dise
Director

December 6, 2024

To Whom It May Concern,

Montgomery County, Md is the fee simple owner of 14335 Cape May Rd, Silver Spring, MD 20904, a 11.73 Acre Parcel that is the home of the County's Colesville Maintenance Depot. The property ID is **District - 05 Account Number – 02257822**.

This letter hereby authorizes Network Towers II, LLC and Drew Patterson or Jim Golden, as authorized signatures, to sign and file any and all application documents, files and plans for the purpose of zoning, permitting and construction of a proposed wireless tower at this location.

This authorization includes preparing applications, plans, permits and all related materials needed to support the filing and processing of the applications and all supporting materials with the applicable governmental bodies.

Sincerely,

Greg Ossont
Deputy Director



December 12, 2024

Network Towers II, LLC
120 Eastshore Drive, Suite 300
Glen Allen, VA 23059

Re: Letter of Intent
New Tower at Colesville Maintenance Depot
14335 Cape May Road Silver Spring, MD 20904
AT&T Site Name: Tamarack (Site ID: 12922574)

To Whom It May Concern:

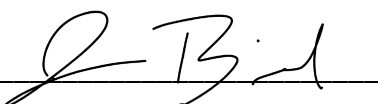
New Cingular Wireless PCS, LLC (AT&T) has engaged Smartlink Group to represent AT&T for all zoning, permitting, and other necessary governmental approvals needed for the AT&T site "Tamarack".

This letter hereby serves as a letter of intent that AT&T will co-locate on the tower proposed by Network Towers II, LLC, once installed.

It is AT&T's intention to co-locate on the tower to provide better coverage along Route 200.

Thank you for your attention to this matter.

Sincerely,

Signature: 

By: Jesse Bird

Its: Principle Tech Vendor Mgmt



December 12, 2024

Jim Golden
Network Building & Consulting
6095 Marshalee Drive, Suite 300
Elkridge, MD. 21075

Re: Castle Cliff - Proposed New Tower at 14335 Cape May Rd., Silver Spring, MD.

20904

Dear Mr. Golden:

T-Mobile, an FCC Licensed Cellular provider in the State of Maryland, is expressing its interest in leasing a proposed communication site called Castle Cliff.

T-Mobile has designed and constructed its wireless network in the Baltimore/Washington area. In order to maintain superior service, we continue to consider opportunities which will improve the network. This proposed location called Castle Cliff will enhance T-Mobile's wireless coverage in the surrounding areas.

This letter is only an expression of interest. The parties shall not be contractually bound unless and until they execute a formal lease, which must be in the form and content satisfactory to each party in their sole discretion. Neither party may rely on this letter as creating any legal obligation of any kind.

Sincerely,

Patrick Riordan

Patrick Riordan

Sr. Manager, Development | DC Eng & Ops

T-Mobile US, Inc.

12050 Baltimore Ave Suite 100, Beltsville, MD
20705

Mobile: (717) 645-9523

Email: patrick.riordan1@t-mobile.com

App No:

2024112367

Application General Information

Applicant Name	Network Towers II, LLC	Received	12/17/2024
Application Type	New	Ann. Plan?	Yes
Carrier	Verizon Wireless	Will site be used to support government telecommunications facilities or other equipment for government use?	No
Solution Type	Macro		
Existing	New		
		Gvt. Use Desc.	

Application Description

This application is for a new 179' 3-sector monopole to be leased, zoned, permitted and maintained by Network Towers , LLC at 14335 Cape May Road, Silver Spring, MD at Montgomery County's Coles ville depot. The lead carrier is Verizon. 3 Carriers are interested in locating on this structure-Please attached Letters of intent from AT&T and T-Mobile. Verizon is the lead carrier. Verizon proposes to install 6 JMA Wireless MX06FHGH65 antennas (2 per sector), 3 Samsung MT6413-77A antenna/RRH combo units (1 per sector). The total proposed lease area is 1815 SF (30'x48' for ground equipment and 15'x25' for potential propane tanks. Verizon's lease area for ground equipment will be 12.5' x 21' Concrete pad. There are (2) Charles equipment cabinets/Cubs proposed- a Charles PM63912TN1 for the radio equipment and a Charles LI-BB24/BB48 Battery Cabinet- see attached updated site plan dated 1/23/25

Site Information

Site Id	798	Zoning	Detached Residential
Structure Type	Monopole	Latitude	39.0897
Street Address	14335 Cape May Road	Longitude	-76.9962
County Site Name	Colesville Depot	Ground Elevation	454
Carrier Site Name	Castle Cliff	City	Silver Springs
Site Owner	Montgomery County	Lease Status	In Process
Structure Owner	To Be built Tower- Network Towers II	Does the structure require an antenna structure registration under FCC Title 47	No
Existing Structure Height		Distance to Residential Property (New, Colocation Only)	775
Provide the proposed height of the new structure without any antenna (New Apps Only)	179'	Distance to Commercial Property (New, Colocation Only)	1143

Justification of why this site was selected:

This search ring has been worked on by all 3 major carriers over the last 10 plus years. All 3 are have committed to colocate on this structure if built. This site borders the ICC Route. Approximately 60,000 cars ravel on this highway daily. The location is >95% residential or Parklands. There was over 25 locations reviewed- 14 of the alternate sites are listed below- no existng sites were found. This is the most commercial property that could work.

NearbySites (New Apps Only):

See list of alternate sites considered on next page.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

Screening considerations(New, Colocation Apps Only):

The site will be occupied by at least 3 carriers and is projected to be a 179' monopole. The Colesville Depot site is a Montgomery County Maintenance yard with heavy equipment, road salt storage, with moderate to heavy traffic going in and out. The site is surrounded by trees on 3 sides and borders the ICC on the south side. Due to the limited commercial or industrial sites in the area- this site is located in the rear of the site- but allows for a 1:1 setback from the ICC side property line. The closest residential property is 775' away to the NNW. Our balloon test consisted of 22 locations. Only 4 were visible. None were visible from 1 mile away.

Some of the Nearby Alternate Sites Considered:

1. Good Hope United Methodist Church- 14680 Good Hope Rd Silver Spring MD- Church board voted against tower
2. Charles Drew Elementary School- 1200 Swingingdale Dr Silver Spring MD- No Interest- Safety Concerns
3. Colesville Local Park/ MD child services- 610 Hobbs Dr Colesville Md- Montgomery County Parks made determination that location was not suitable for a tower
4. Peach Wood Park- 39.097184, -76.996847- Montgomery County Parks made determination that location was not suitable for a tower
5. Good Hope Community Center- 14715 Good Hope Rd Silver Spring MD- Montgomery County denied the tower at the community center
6. Good Hope Local Park- 39.096295, -76.984786- Montgomery County Parks deemed that the location was not suitable for a tower
7. Washington Zion Presbyterian Church- 14655 Good Hope Rd Silver Spring Md- No interest
8. MDOT Property on ICC- 39.08984/-76.9867- MDOT rejected due to safety concerns
9. Transfiguration Church- 13925 New Hampshire Ave Silver Spring Md- Interested in Raw land but not much room and tough zoning case with setbacks and Just out of search ring
10. Fire Alliance Church- 14500 New Hampshire Ave Silver Spring Md- Currently Tmobile in Steeple- only 40' high. Landlord is open to Rawland but said they have future plans for property where tower could go - outside of search ring
11. Heyser Farms- 14526 New Hampshire Ave Silver Spring Md- Landlord not interested and Out of search ring
12. MDOT Location along the **CC** Highway- 39.089421, -76.983101- rejected by MDOT.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

6409 Questions

Does this qualify as a 6409 application? (Minor Mod, Colocations Only)

For towers outside the public ROW will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 20 feet, whichever is greater?

Will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 6 feet?

For towers outside the public ROW will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 20 feet?

Will the proposed installation require more the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets?YN

Will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 10 feet, whichever is greater?

Does the structure or current installation have concealment elements/measures?

Will the proposed installation require excavation or expansion outside the current boundaries of the site?

If yes, describe how the proposed installation does not defeat the existing concealment.

Small Wireless Facility Information

Small Wireless Facility Questions

Small Wireless Facility?

Is the structure 10% taller than adjacent structures?

Cumulative volume of the proposed wireless equipment(s) exclusive of antennas in cubic feet

Please list adjacent structure heights

Tribal Lands?

Cumulative volume of the proposed antenna(s) exclusive of equipment in cubic feet

ROW Information

PROW?

Pole Number

ROW owner

ROW width

Wednesday, December 18, 2024

7:49:12 PM

App No: 2024112367

Antenna Information

Antenna ComplianceYes

Compliance Desc

Antenna LocationYes

Antenna Loc. Desc.

Env. Assessment

Cat. Excluded?

Routine Env. EvaluationYes

Antenna ModelJMA MX06FHG865-HG

Frequency746-2180 MHZ

RAD Center174Max ERP14791 WAntenna Dimensions96"x12.2"x7.5"Quantity6

Antenna Model	Samsung MT 6413-77A						
Frequency	3700-3980 MHZ						
Rad Center	174'	Max ERP	30903 W	Antenna Dimensions	15.75" X 28.9" X 5.51"	Quantity	3

Frequency band	Band	EARFCN	DL Range Mhz	UL Range Mhz	Antenna		
700 upper C	B 13	5230	746-756	777-787	JMA MX06FHG865		
850	B 5	2560	880-890	835-845	JMA MX06FHG865		
PCS	B 2	1125	1975-1990	1895-1910	JMA MX06FHG865		
AWS	B 4	2125	2120-2135	1720-1735	JMA MX06FHG865		
AWS3	B 66	67086	2170-2180	1770-1780	JMA MX06FHG865		
C-Band	B n77	650006;655324	3800-3960	3800-3960	Samsung MT6413-77A		



International
Maryland Fence

GOO

Florine Professional Hair Braiding

Hoxsen Farms, Inc.

Spring Bunnies Family Home Daycare

CITGO AT ICC

Castle Cliff Monopole

14335 Cape May Rd

McCo Colesville Depot

200

200

Quality Insulation

Colesville Manor Dr

Casa De Montessori

Image NASA

Colesville Local Park

778 ft

Hobbs Dr

Hobbs Dr

lat 39.106765° lon -77.016150° elev

102 MMU Product Specification

for MT6413-77A

Describes the product components, physical nature, functions, specifications, ports, and LED information, and their characteristics as a reference for installation and O & M activities.

Document Version 1.0
February 2023

© 2023 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

70315

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

TIMS@sea.samsung.com

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	viii
	Personal and Product Safety	ix
	Equipment Markings	xiii
Chapter 1	Introduction	1
	Overview	1
	Functional Description	3
	<i>Clock</i>	3
	<i>Cooling</i>	3
	Specifications	4
Chapter 2	External Interface	6
	Port Information	6
	LED Operation	7
Appendix	Acronyms	9

70315

List of Figures

Figure 1.	MT6413-77A Appearance	1
Figure 2.	Block Diagram	3
Figure 3.	MT6413-77A Port Information.....	6
Figure 4.	MT6413-77A LED Information	7

70315

List of Tables

Table 1. Name and Description of Units 2

Table 2. Specifications of the MT6413-77A 4

Table 3. MT6413-77A Port Information..... 6

Table 4. SYS LED 7

Table 5. OPT LED 8

Table 6. PWR LED 8

70315

Preface

This document describes the MT6413-77A of Massive MIMO Unit (MMU) in a 5G network.

The document provides information useful to network operators during the installation, operation, and management cycles. It includes information such as the radio unit functions, hardware configuration, ports, and LED information.



Some hardware configurations are not supported by all software releases or approved for all markets.

Relevance







This manual applies to the following products/software.

Name	Type
MT6413-77A (3.7 GHz)	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`.
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STs**, **eutran-cell-conf-idle**, or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	February 2023	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the hardware overview, functional description, and general specification of the product.
Chapter 2	External Interface	This chapter describes the external interfaces of the radio unit in detail.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 101 5G gNB System Description
- 201 5G gNB Dimensioning and Configuration Manual
- 310 MMU Installation Manual for MT6413-77A

70315

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by UL 62368-1. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under UL 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed in order to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with UL 62368-1, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of UL 62368-1 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery.

End-of-life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California, USA.

‘Perchlorate Material-special handling may apply; see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

70315

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

MMU should be grounded.

Chapter 1 Introduction

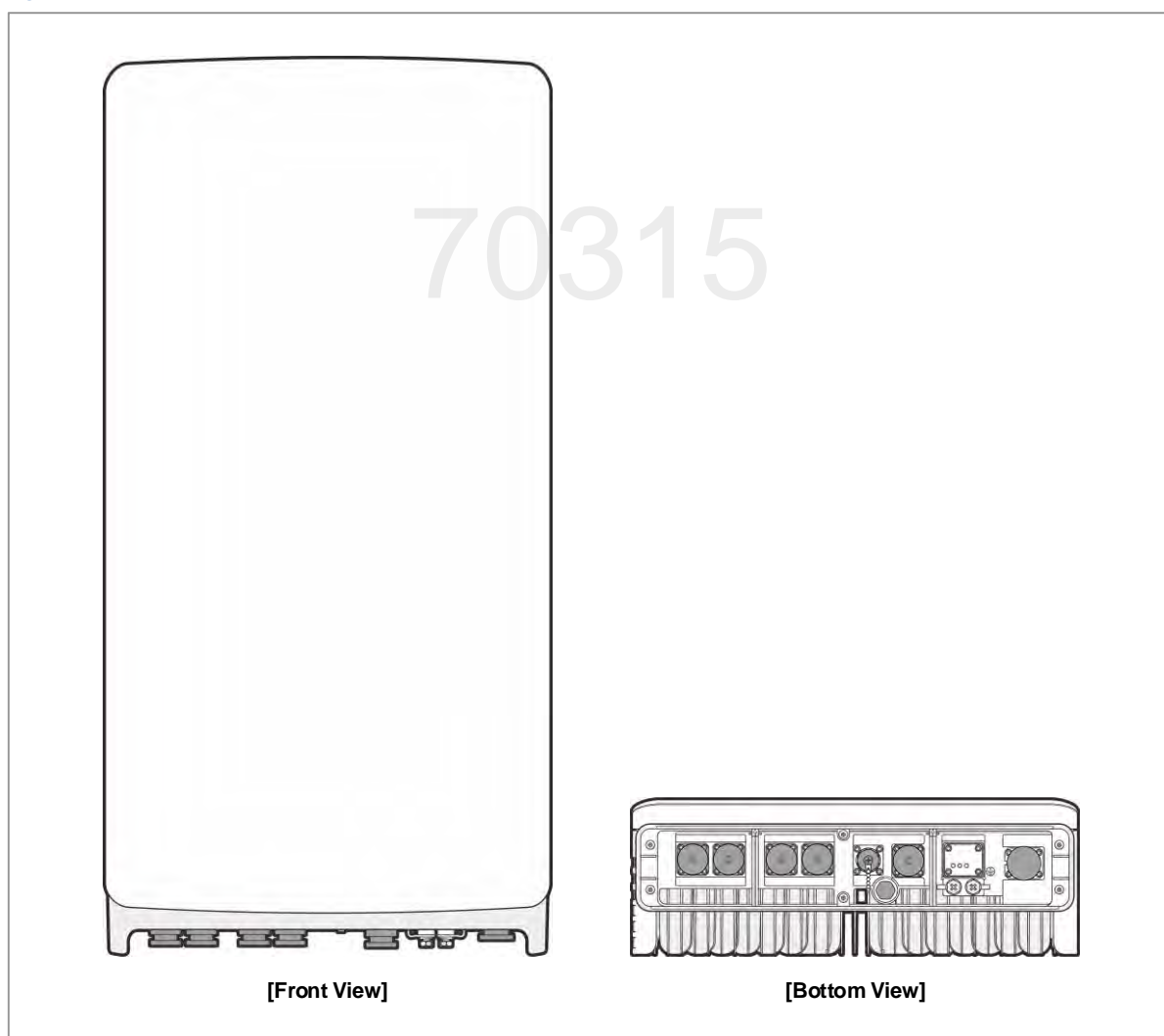
This chapter provides the hardware overview, functional description, and general specification of the product.

Overview

The MT6413-77A is a Massive MIMO Unit (MMU) consisting of digital and radio blocks. The digital block supports the interface with Digital Unit (DU) and the Low-PHY function (functional split option 7-2). The radio block transmits and receives the Radio Frequency (RF) signals with an integrated 64T64R antenna.

The following figure depicts the appearance of the MT6413-77A.

Figure 1. MT6413-77A Appearance



The following table outlines the name and description of the MT6413-77A.

Table 1. Name and Description of Units

Model Name	Description
MT6413-77A	3.7 GHz NR 64T64R 320 W MMU



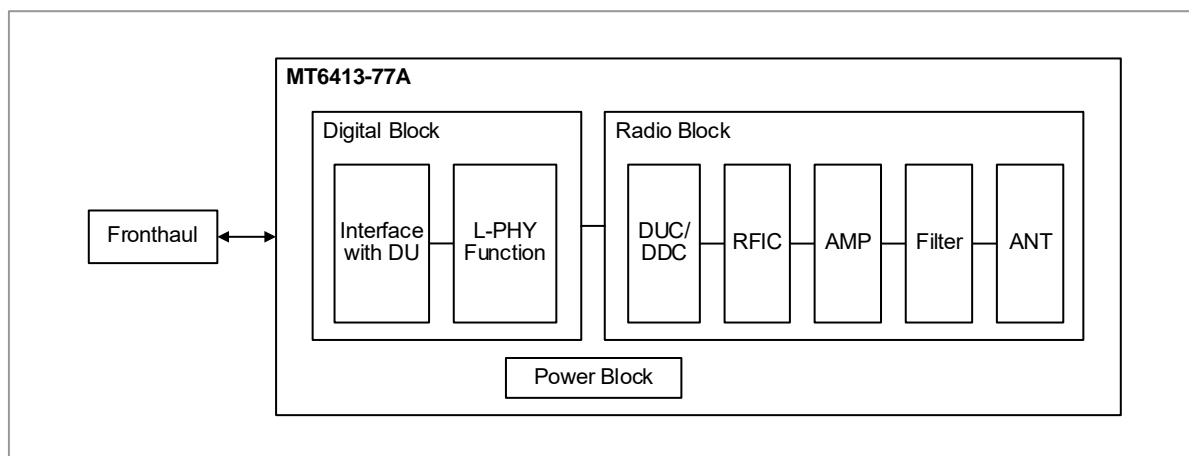
Some hardware configurations are not supported by all software releases or approved for all markets.

70315

Functional Description

The following figure depicts the block diagram of the MT6413-77A.

Figure 2. Block Diagram



The MT6413-77A consists of the digital block, the radio block, and the power block. The digital block consists of the interface block and the L-PHY block. The digital block supports the interface with the DU, operation, and management of the MT6413-77A and processes the L-PHY function, such as precoding, digital beamforming, iFFT/FFT, and so on.

The radio block consists of the digital up/down converter, RFIC (digital/analog converter), amplifier, filter, and 64T64R antenna.

Clock

The MT6413-77A supports CPRI clock recovery and IEEE1588v2/SyncE synchronization.

The MT6413-77A receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the MT6413-77A generates and distributes the clock for internal devices.

Cooling

The MT6413-77A uses a natural convection cooling method without using a fan.

Specifications

The following table displays the main specifications of the MT6413-77A.

Table 2. Specifications of the MT6413-77A

Item		MT6413-77A
Air Technology		5G
Band/Duplex		n77/TDD
OFR		3,700 to 3,980 MHz
IBW		200 MHz
OBW		200 MHz
Carrier Configuration	Ch. BW	NR 20/40/60/80/100 MHz
	Number of carriers (per unit)	2CC
TRX Path Configuration		64T64R
Antenna Configuration		4V16H 192 AE (3 x 1 sub-array)
Conductive Power		320 W
MIMO Capacity		DL 16L, UL 16RX (8L)
Function Split		Opt. 7-2x
Optic Interface		20 km, 25 Gbps × 4 ports
Input Voltage		-48 V DC (-36 to -58 V DC)
Power Consumption ^{a)}		<ul style="list-style-type: none"> • 882 W @ 40 % room temp • 1,260 W @ 100 % room temp • 1,299 W @ 100 % all temp
Volume / Dimension (W x H x D)		41.1 L / 15.75 x 28.9 x 5.51 in. (400 x 734 x 140 mm)
Weight		57.32 lb (26 kg) or less (without a Bracket)
Operating Temperature ^{b)}		-104 °F to +131 °F (-40 °C to +55 °C), (without solar load)
Cooling Scheme		Natural Convection
Installation		Pole, Wall
Operating Humidity ^{b)}		5% to 100% RH (non-condensing, not to exceed 30 g/m ³ absolute humidity)
Altitude		Telcordia GR-63-CORE, Issue 5, Section 4.1.3
Noise		Telcordia GR-487-CORE, Issue 5, Section 3.34 (45 dBA)
Ingress Protection Rating		IEC 60529 (IP65)
Salt Fog / Salt Spray		Telcordia GR-487-CORE, Issue 5, Section 3.40.1
Wind Resistance		Telcordia GR-487-CORE, Issue 5, Section 3.36
Earthquake		Telcordia GR-63-CORE, Issue 5, Section 4.4.1 (Zone 4)
Vibration		Telcordia GR-63-CORE, Issue 5, Section 4.4.4 / 4.4.5
EMC		FCC Title 47 CFR Part 15 Subpart B

Item	MT6413-77A
Safety	UL 62368-1
RF	FCC Title 47, CFR Part 27



1) These values are predictive of simulation. When development is completed, measurement data can change by +/- 10%.



2) Temperature and humidity are measured 1.5 m above the floor and 400 mm from the equipment's front panel.

70315

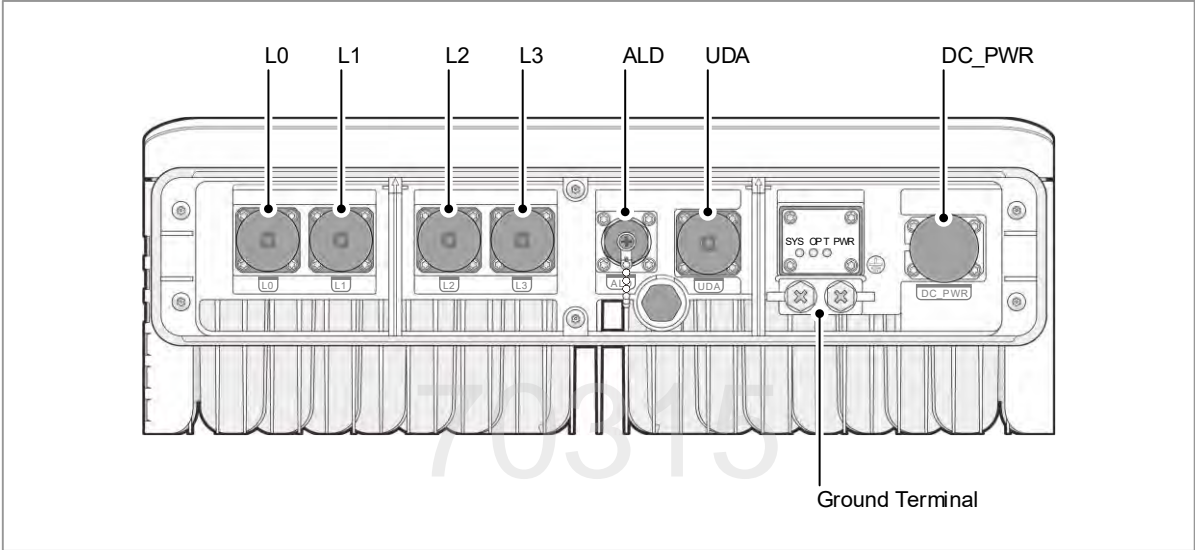
Chapter 2 External Interface

This chapter describes the external interfaces of the radio unit in detail.

Port Information

The following figure depicts the port information of the MT6413-77A.

Figure 3. MT6413-77A Port Information



The following table outlines the port information of the MT6413-77A.

Table 3. MT6413-77A Port Information

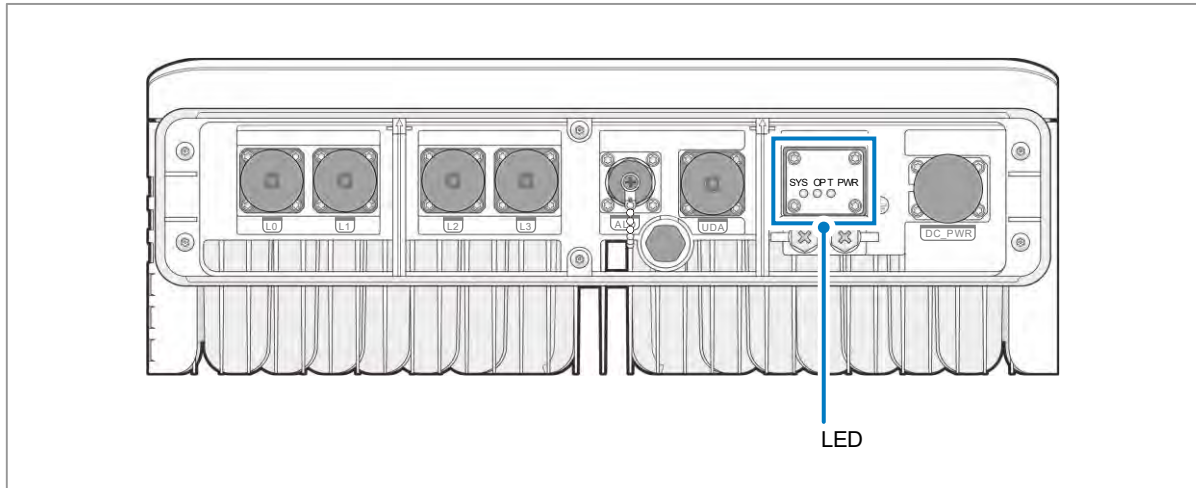
Port Name	Connector Type	Description
L0, L1, L2, L3	Push pull, SFP28 type	25GbE fronthaul optic interface
UDA	Push pull, RJ45 type	User-defined alarm (4 Rx)
DC_PWR	Push pull	-48 VDC (-36 to -58 VDC)
SYS, OPT, PWR	LED	Status LED for system, optic, power

LED Operation

The MT6413-77A displays the device status through the LED.

The following figure depicts the LED position of the MT6413-77A.

Figure 4. MT6413-77A LED Information



The following table describes the meaning of different LED states.

Table 4. SYS LED






Status	Description	
	Solid Red	<ul style="list-style-type: none"> Abnormal condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The CPRI link is not set up. The RU initialization is in progress (all paths are disabled).
	Blinking Red	<ul style="list-style-type: none"> Imperfect condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and at least one path functions properly.
	Solid Green	<ul style="list-style-type: none"> Standby condition No path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The RU initialization is complete and ready to send the notification message to the DU.
	Blinking Green	<ul style="list-style-type: none"> Normal condition No path has been shut down by a major alarm or disabled alarm, and at least one path functions properly. At least one carrier in the path functions properly in a multi-carrier case.
	Off	No DC input power

Table 5. OPT LED











Status		Description
	Solid Red	Optic RX LOS or optic Tx fault at all ports
	Blinking Red	Optic RX LOS or optic Tx fault at one of the port
	Solid Green	No optical module insert
	Blinking Green	No alarm, normal condition
	LED OFF	No DC input power

Table 6. PWR LED

Status		Description
	Solid Red	Shut down by Voltage High/Low major alarm.
	Blinking Red	Reserved.
	Solid Green	Reserved.
	Blinking Green	No alarm, normal condition
	OFF	No DC input power



70315

Appendix Acronyms

ADC	Analog to Digital Converter
AMP	Amplifier
ANT	Antenna
CPRI	Common Public Radio Interface
DDC	Digital Down Converter
DU	Digital Unit
DUC	Digital Up Converter
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
gNB	next generation Node B
LED	Light Emitting Diode
L-PHY	Low Physical Layer
MMU	Massive MIMO Unit
NR	New Radio
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
RU	Radio Unit
SFP	Small Form Factor Pluggable
UDA	User Defined Alarm

70315

102 MMU
Product Specification for MT6413-77A

Document Version 1.0

© 2023 Samsung Electronics Co., Ltd.
All rights reserved.

102 RRU Product Specification

for RF4439d-25A

Describes the product components, physical nature, specific functions, specifications, ports and LED information along with their characteristics as a reference for installation and O&M activities.

Document Version 1.0
July 2021

© 2021 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

[NetSys Tech Writer@sea.samsung.com](mailto:NetSys_Tech_Writer@sea.samsung.com)

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	vii
	Personal and Product Safety	viii
	Equipment Markings	xii
Chapter 1	Introduction	1
Chapter 2	Overview	2
	Functional Description	4
	Hardware Block Diagram.....	4
	Clock	5
	Cooling	6
	<i>AISG 3.0</i>	6
	Specifications	7
Chapter 3	External Interface	9
	<i>LED Information</i>	10
	<i>Port Information</i>	11
Appendix	Acronyms	12

List of Figures

Figure 1.	Appearance	3
Figure 2.	4Tx/4Rx RRU Block Diagram.....	5
Figure 3.	AISG Interface	6
Figure 4.	External Interface	9

List of Tables

Table 1.	Name and Description of Units	2
Table 2.	Specifications (RF4439d-25A)	7
Table 3.	RF4439d-25A SYS LED Information	10
Table 4.	RF4439d-25A OPT LED Information	10
Table 5.	RF4439d-25A ANT LED Information	10
Table 6.	RF4439d-25A RET LED Information	11
Table 7.	RF4439d-25A Port Information	11

Preface

The Samsung eNB consists of Digital Unit (DU) and Remote Radio Unit (RRU). This manual describes the product components and is used as the reference for installation and O&M. It specifies the hardware configuration, functions, specifications, physical ports, and LED information of the RRU hardware.



Few hardware configurations are not supported by all the software releases or approved for all the markets.

Relevance

This manual applies to the following products/software.

Name	Type
RF4439d-25A PCS/AWS FDD 4Tx/4Rx RRU	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STS**, **eutran-cell-conf-idle** or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	July 2021	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the introduction.
Chapter 2	Overview	This chapter provides the hardware overview, functional description, and general specifications.
Chapter 3	External Interface	This chapter describes the LED information, and the port information of the Radio Unit.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 201 LTE eNB Dimensioning and Configuration Manual
- 101 LTE eNB System Description
- 310 LTE RU (RRU) Installation Manual

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by IEC/EN/UL/CSA 62368 or 60950. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under EN 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with IEC/EN/UL/CSA 62368 or 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of IEC/EN/UL/CSA 62368 or 60950 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery.

End of life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California USA.

‘Perchlorate Material-special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

RRU should be grounded.

Chapter 1 Introduction

The Samsung eNB consists of the Digital Unit (DU) and the Radio Unit (RU). The DU is a digital unit and can be mounted in to an indoor or outdoor 19-inch commercial rack. The RU is a RF integration module consisting of a transceiver, power amplifier, and filter. It transmits and receives traffic, clock information, and alarm and control messages to and from the DU.

This document describes the product components, serving as the reference for installation and O&M. It specifies hardware configuration, functions, specifications, component ports, and LED information of the RU hardware component.

The document is divided into three chapters. An overview of all the chapters is given in this section.

- Introduction
This chapter provides an introduction of the document.
- Overview
This chapter describes the hardware overview, functional description, and general, mechanical and environmental specification for the RU products.
- Radio Units
This chapter describes hardware components of radio unit in detail, such as appearance of external interface, and detail information of ports and LED.
- Acronyms
This appendix spells out the acronyms used in this document.

Chapter 2 Overview

The Remote Radio Unit (RRU) consists of the RF chains of 4Tx/4Rx which is an integrated RF unit that includes a transceiver, a power amplifier, and a filter in an enclosure.

The following table outlines the name and description of the RRU (RU).

Table 1. Name and Description of Units

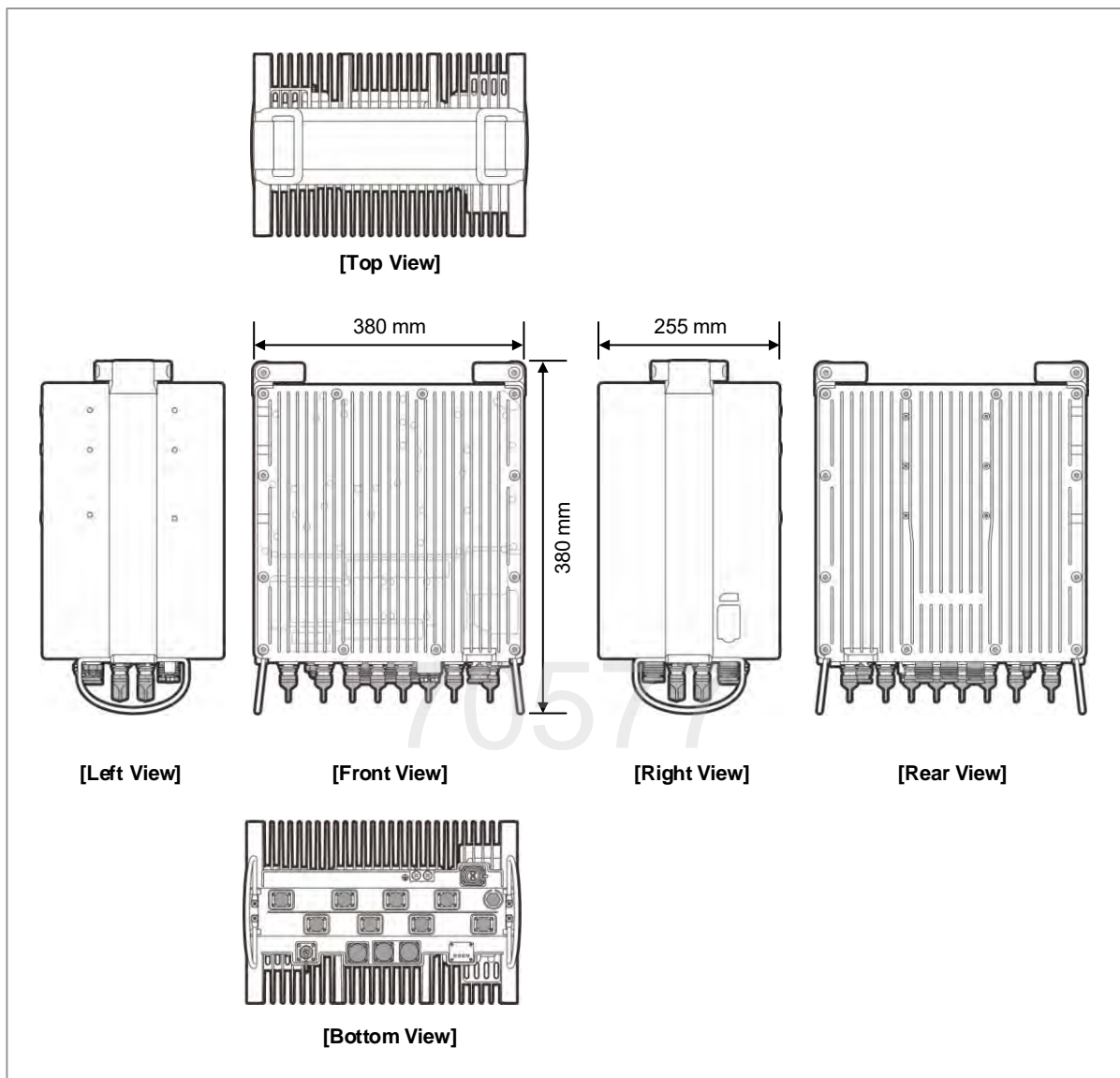
Model Name	Description
RF4439d-25A	PCS/AWS FDD 4Tx/4Rx RRU (RU)



Few hardware configurations are not supported by all the software releases or approved for all the markets.

The following figure depicts the physical view of the RRU (RF4439d-25A):

Figure 1. Appearance



Functional Description

In downlink path, the RRU performs Optical-to-Electrical (O/E) conversion for baseband signals received from the DU via the optic CPRI (SVR21C) or optic eCPRI (SVR21D). Then, the electrical digital signals are converted into analog signals by the DAC. The frequency of these analog signals is converted upward through the modulator and these signals are amplified into high-power RF signals through the power amplifier. The amplified signals are transmitted to antenna through the filter.

In uplink path, the RF signals received through filter of the RRU are low-noise amplified by the Low Noise Amplifier (LNA) and their frequency is down-converted through the demodulator. These down-converted frequency signals are converted into baseband signals through the ADC. The signals converted into baseband are changed to Electrical-to-Optical (E/O) and transmitted to the DU through the CPRI.

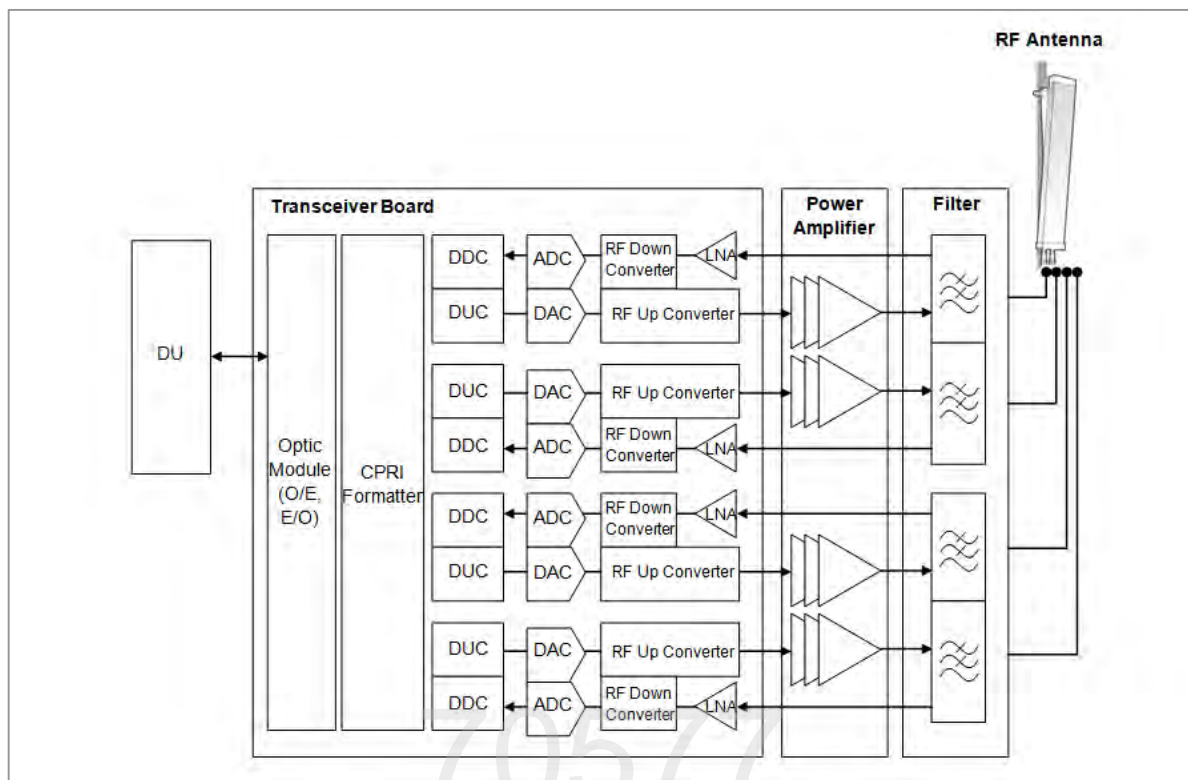
The DU transmits control signals to the RRU via the control path (channel) of the CPRI.

Hardware Block Diagram

The description for the block diagram is given in the above section.

The following figure is the block diagrams of 4Tx/4Rx RRU:

Figure 2. 4Tx/4Rx RRU Block Diagram



Clock

The RRU supports the CPRI clock recovery (SVR21C) and IEEE1588v2/SyncE synchronization (SVR21D).

The RRU receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the RRU generates and distributes the clock for internal devices.

Cooling

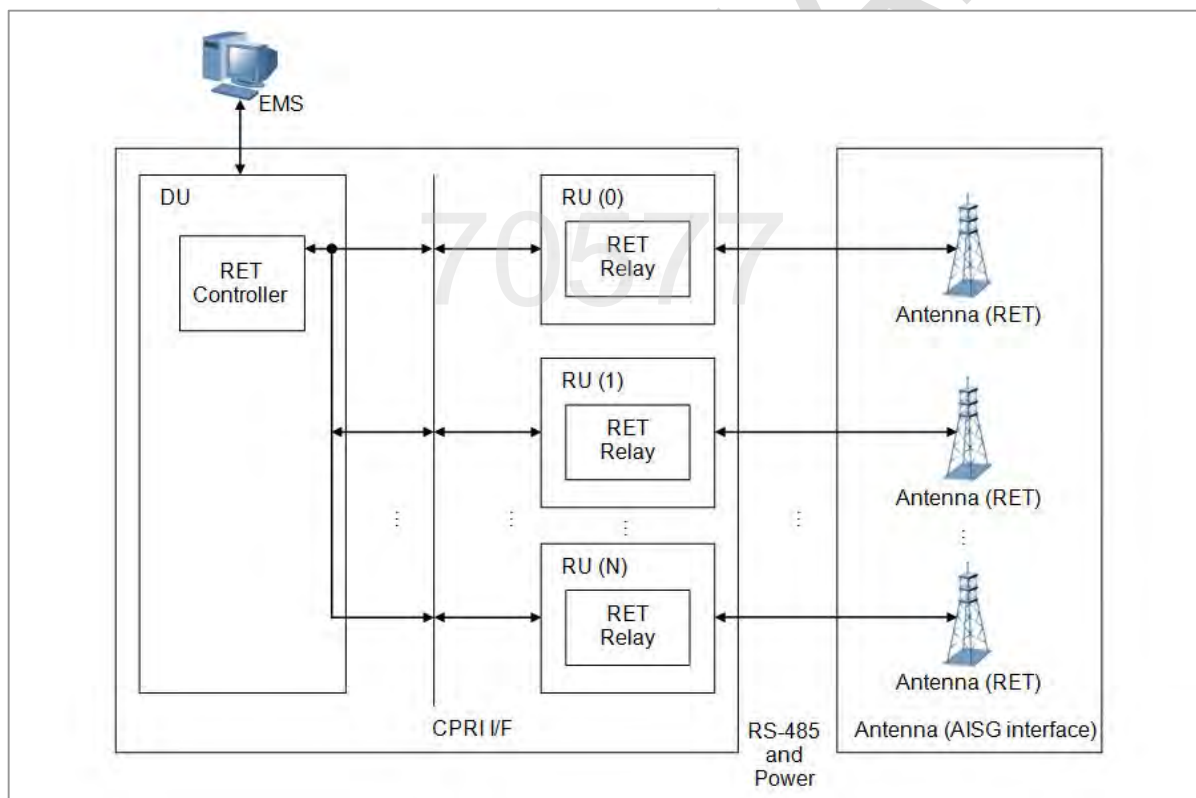
The RRU is designed to discharge the heat effectively through natural cooling without additional cooling devices.

AISG 3.0

The Samsung eNB can provide Remote Electrical Tilt (RET) function by connecting the AISG 3.0 interface-compatible antenna to the RRU.

For the RET function, the Samsung eNB transmits and receives control messages to and from the EMS via the RET controller in the Main Card. The EMS can remotely control the tilting angle of the antenna. In addition, the RRU provides power to the RET device of the antenna for the RET operation. Refer to the following block diagram:

Figure 3. AISG Interface



Specifications

The following table outlines the main specifications of RF4439d-25A.

Table 2. Specifications (RF4439d-25A)

Category		Description
Air Standard		LTE and 5G NR
Duplex Type		FDD
Antenna Port Configuration		For AWS/PCS band respectively, 4T4R: T/R T/R T/R T/R 2T4R: T/R T/R R R 2T2R: T/R T/R 2T2R + 2T2R 2sector
Operating Frequency	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,930 - 1,995 MHz B66(B4)/n66(n4): 2,110 - 2,200 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,850 - 1,915 MHz B66(B4)/n66(n4): 1,710 - 1,780 MHz
Channel Bandwidth ^{a)}		5/10/15/20 MHz (LTE/NR)
IBW	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4): 90 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4) : 70 MHz
Max number of Carriers		5/10/15/20 MHz 4T4R case: Total Max. 7CC within (PCS: 3CC, AWS: 5CC)
OBW		<ul style="list-style-type: none"> B25(B2)/n25(n2): 30MHz B66(B4)/n66(n4): 60MHz
Output Power		Max. 320 W within, <ul style="list-style-type: none"> B25(B2)/n25(n2): 40 W x 4 path or 60 W x 2 path B66(B4)/n66(n4): 60 W x 4 path or 80 W x 2 path
Fronthaul Interface		Optical (e)CPRI 2 port (10 Gbps x 2 port)
Function Split		DL/UL Option 8 (SVR21C) DL/UL Option 7-2x Cat.A (SVR21D)
Dimension (W x H x D)		380 x 380 x 255 mm (14.96 x 14.96 x 10.04 inch) Excluding connector, partial extrusion, flange
Weight (kg)		Under 33.9 (excluding bracket) 74.74 lbs
Cooling		Natural convection cooling
Input Voltage		-48 V DC (-38 V to -57 VDC)
Power consumption		<ul style="list-style-type: none"> Typical (W)-Load 100 % 1270 W @ room temp Maximum (W)-Load 100 % 1459 W @ all temp
Operating Temperature		<ul style="list-style-type: none"> -40 °C to 55 °C (without solar load) -40°C to 50°C (with solar load)
Operating Humidity		5% to 100%RH (Condensing, not to exceed 30g/m3 absolute humidity)
Installation		Pole, wall, tower, side-by-side, back to back

Category	Description
Vibration	Telcordia GR-63-CORE, Issue5, <ul style="list-style-type: none">• Office Vibration (Section 4.4.4)• Transportation Vibration (Section 4.4.5)
Ingress Protection Rating	IP65 (IEC 60529)
RF	FCC Title 47 CFR Part 27, 24
Safety	UL 62368-1



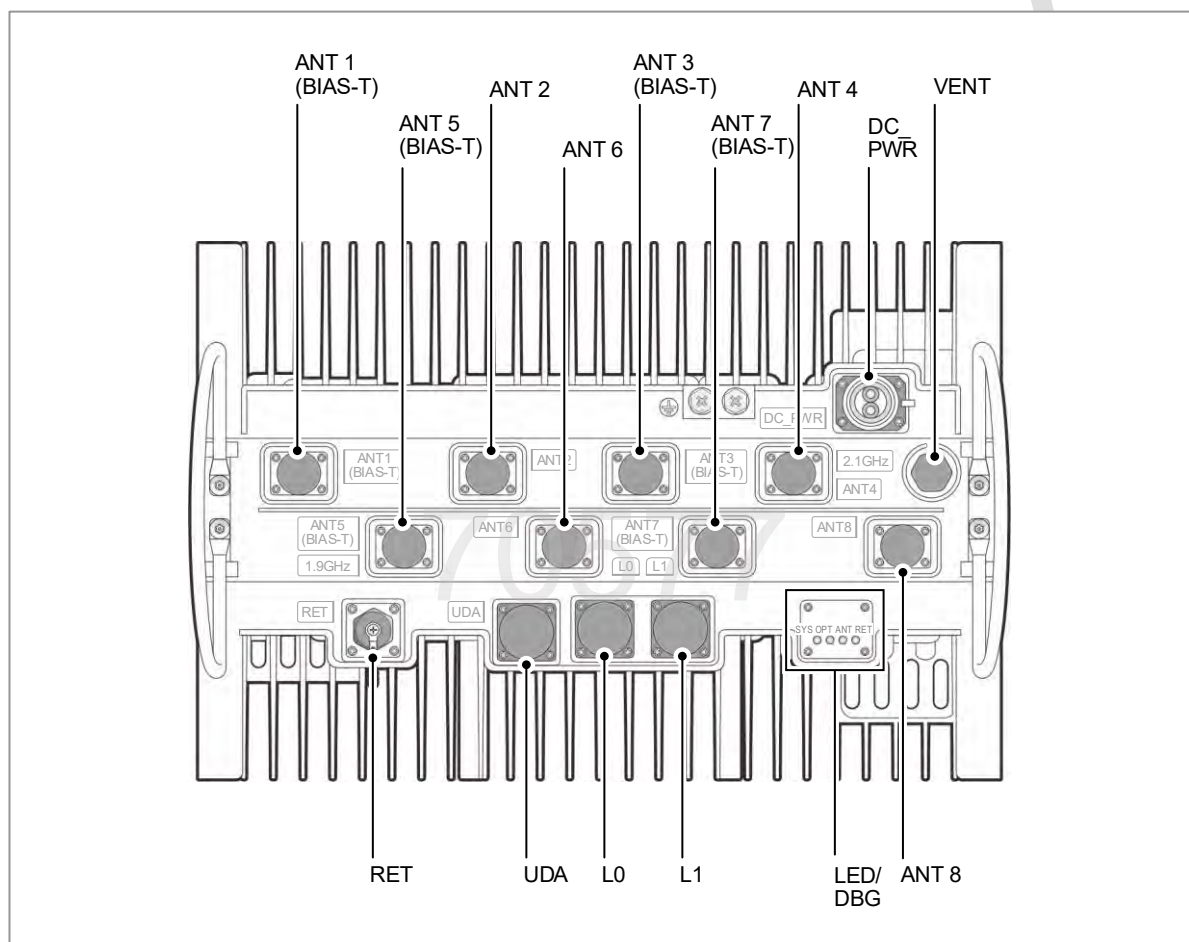
The power consumption is predicted with a simulation and the measured value is subject to change by $\pm 10\%$.

Chapter 3 External Interface

This chapter describes the LED information, and the port information of the RF4439d-25A.

The following figure depicts the external interface of the RF4439d-25A.

Figure 4. External Interface



LED Information

The LED displays the current status of RF4439d-25A as described in the following tables.

Table 3. RF4439d-25A SYS LED Information






Status	Description
	Green Blinking <ul style="list-style-type: none"> Normal condition No path has shut down by major alarm or disable alarm and at least one path works in normal operation. In multi-carrier case, at least one carrier in path works in normal operation.
	Green ON <ul style="list-style-type: none"> Standby condition No path has shut down by major alarm or disable alarm and no path works in normal operation. The RRU initialization is completed and ready to send the notification message to the DU.
	Red Blinking <ul style="list-style-type: none"> Imperfect condition due to the alarm At least one path has shut down by major alarm or disabled alarm and at least one path works in normal operation
	Red ON <ul style="list-style-type: none"> Abnormal condition due to the alarm At least one path has shut down by the major alarm or disabled alarm (Except for Voltage High/Low Major Alarm) and no path works in normal operation. The CPRI link is not set up. The RRU Initialization is in progress. (All paths are disabled.)
	OFF <ul style="list-style-type: none"> Shut down by Voltage High/Low Major Alarm

Table 4. RF4439d-25A OPT LED Information






Status	Description
	Green Blinking No Alarm, Normal condition
	Green ON No optical module insert
	Red Blinking Optic RX LOS or Optic Tx fault at one of the port
	Red ON Optic RX LOS or Optic Tx fault at all the ports
	OFF RRU input power off (No DC or AC input power)

Table 5. RF4439d-25A ANT LED Information












Status	Description
	Green Blinking No VSWR Alarm, Normal condition
	Green ON No RF output power (PA disable)
	Red Blinking VSWR Alarm occurs at one of the paths.
	Red ON VSWR Major Alarm (All paths)
	OFF RRU input power off (No DC or AC input power)

Table 6. RF4439d-25A RET LED Information

Status	Description	
	Green Blinking	When the RRU receives data by the RET.
	Green ON	<ul style="list-style-type: none"> RET power is OK. There is no RET data received for 180 s.  If RET is disconnected, the blinking green status can last for 180 s.
	Red Blinking	Reserved.
	Red ON	RET power fails.
	OFF	RRU input power off (No DC or AC input power).

Port Information

The following table outlines the port information of the RF4439d-25A.

Table 7. RF4439d-25A Port Information

Port Name	Connector Type	Description
RET	8-pin Circular	AISG interface
L0, L1,	Push pull, SFP+	CPRI optic connector used to connect to the DU 10Gbps fronthaul optic interface, 2 ports, 20 km <ul style="list-style-type: none"> Number marking: #0 - 1
DC_PWR	Push pull	-48 VDC (-38 to -57 VDC)
ANT_1 - 8	4.3-10 Plus female	TX/RX RF Antenna
UDA	Push pull, RJ45 type	User defined alarm (4 Rx)
LED	-	SYS, OPT, ANT, RET

Appendix Acronyms

ADC	Analog to Digital Converter
AISG	Antenna Interface Standard Group
CPRI	Common Public Radio Interface
DAC	Digital to Analog Converter
DU	Digital Unit
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
FITF	Field Installation Test Function
FPGA	Field Programmable Gate Array
LNA	Low Noise Amplifier
LSM	LTE System Manager
MMU	Massive MIMO Unit
RET	Remote Electrical Tilting
RF	Radio Frequency
RRU	Remote Radio Unit
RU	Radio Unit
SFP	Small Form Factor Pluggable
SMA	Sub Miniature Version A
UDA	User Defined Alarm

PRELIMINARY

102 RRU
Product Specification for RF4439d-25A

Document Version 1.0

© 2021 Samsung Electronics Co., Ltd.
All rights reserved.



MX06FHG865-HG

NWAV™ X-Pol Hex-Port Antenna

X-Pol Hex-Port 8 ft 65° Form in Tighter High Gain (FHG) with Smart Bias Ts, 698-2180 MHz:

2 ports 698-894 MHz and 4 ports 1695-2200 MHz

- Industry-leading high gain for MB and LB for extended cell coverage
- Excellent passive intermodulation (PIM) performance reduces harmful interference.
- Fully integrated (iRETs) with independent RET control for low and high bands for ease of network optimization
- Suitable for LTE/CDMA/PCS/UMTS/GSM air interface technologies
- Integrated Smart Bias-Ts reduce leasing costs
- Optimized width for reduced wind loading



NWAV™

Electrical specification (minimum/maximum)	Ports 1, 2		Ports 3, 4, 5, 6		
Frequency bands, MHz	698-806	806-894	1695-1880	1850-1990	1920-2200
Polarization	± 45°		± 45°		
Max gain over all tilts, dBi	17.2	17.6	19.4	19.5	20.0
Average gain, dBi	17.1 ± 0.1	17.3 ± 0.3	19.3 ± 0.1	19.2 ± 0.3	19.7 ± 0.3
Horizontal beamwidth (HBW), degrees	67.0	65.0	63.0	63.0	62.0
Front-to-back ratio, co-polar power @180°± 30°, dB	>25.0	>25.0	>28.0	>26.0	>25.0
X-Pol discrimination (CPR) at boresight, dB	>20.0	>18.0	>25	>20	>18
Sector power ratio, percent ¹	<4.0	<3.6	<5.0	<3.8	<3.6
Vertical beamwidth (VBW), degrees ¹	9.3	8.4	5.0	4.9	4.5
Electrical downtilt (EDT) range, degrees	0-10		0-7		
First upper side lobe (USLS) suppression, dB ¹	≤-16.0	≤-15.0	≤-16.0	≤-16.0	≤-16.0
Cross-polar isolation, port-to-port, dB ¹	25	25	25	25	25
Max VSWR / return loss, dB	1.5:1 / -14.0		1.5:1 / -14.0		
Max passive intermodulation (PIM), 2x20W carrier, dBc	-153		-153		
Max input power per any port, watts	300		250		
Total composite power all ports, watts	1500				

¹ Typical value over frequency and tilt



MX06FHG865-HG

NWAV™ X-Pol Hex-Port Antenna

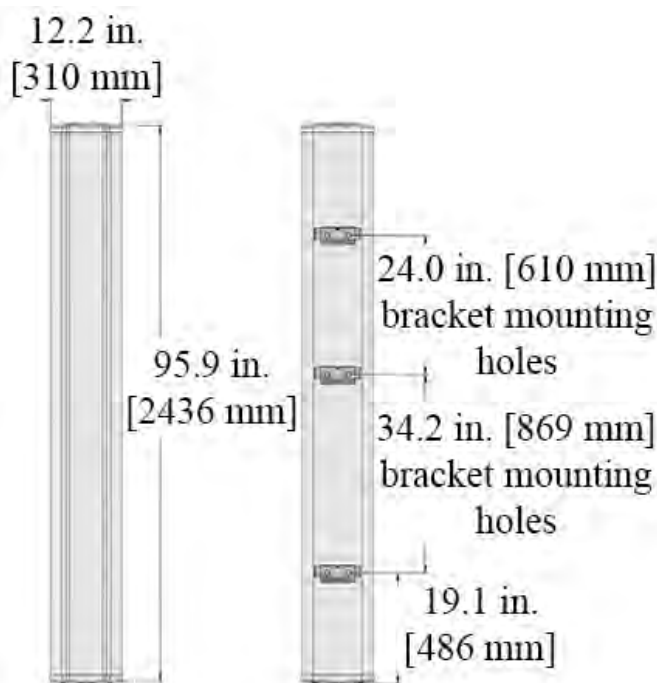
Mechanical specifications

Dimensions height/width/depth, inches (mm)	95.9/ 12.2/ 7.5 (2436/ 310/ 191)
Shipping dimensions length/width/height, inches (mm)	106/ 20/ 15 (2692/ 508/ 381)
No. of RF input ports, connector type, and location	6 x 4.3-10 female, bottom
RF connector torque	96 lbf-in (10.85 N·m or 8 lbf-ft)
Net antenna weight, lb (kg)	51 (23.1)
Shipping weight, lb (kg)	100 (45.3)
Antenna mounting and downtilt kit included with antenna	91900318, 91900319 (middle bracket)
Net weight of the mounting and downtilt kit, lb (kg)	26 (11.82)
Range of mechanical up/down tilt	-2° to 12°
Rated wind survival speed, mph (km/h)	150 (241)
Frontal and lateral wind loading @ 150 km/h, lbf (N)	90.5 (402.6), 81.2 (361.2)
Equivalent flat plate @ 100 mph and Cd=2, sq ft	2.27
EPA frontal and lateral, ft², (m²)	4.1 (0.38), 2.2 (0.20)

Front view

Back view

Bottom view



Ordering information

Antenna model	Description
MX06FHG865-HG	8F X-Pol HEX FHG 65°, 0-10° / 0-7° RET, 4.3-10 & SBT
Optional accessories	
AISG cables	M/F cables for AISG connections
PCU-1000 RET controller	Stand-alone controller for RET control and configurations

Remote electrical tilt (RET 1000) information

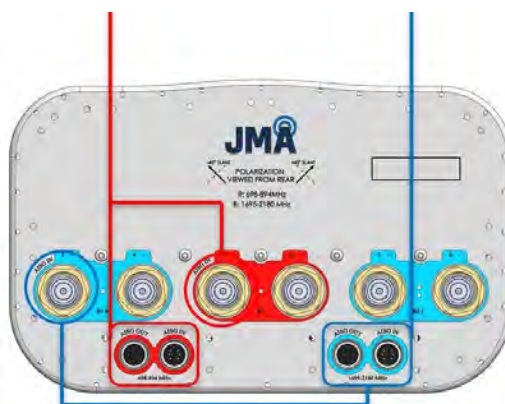
RET location	Integrated into antenna
RET interface connector type	8-pin AISG connector per IEC 60130-9
RET connector torque	Min 0.5 N·m to max 1.0 N·m (hand pressure & finger tight)
RET interface connector quantity	2 pairs of AISG male/female connectors
RET interface connector location	Bottom of the antenna
Total no. of internal RETs (low bands)	1
Total no. of internal RETs (high bands)	1
RET input operating voltage, vdc	10-30
RET max power consumption, idle state, W	≤ 2.0
RET max power consumption, normal operating conditions, W	≤ 13.0
RET communication protocol	AISG 2.0 / 3GPP

RET and RF connector topology

Each RET device can be controlled either via the designated external AISG connector or RF port as shown below:

RET device	Band	RF port
R1	698-894	1-2

RET device	Band	RF port
B1/B2	1695-2200	3-6



Array topology

3 sets of radiating arrays

R1: 698-894 MHz
B1: 1695-2200 MHz
B2: 1695-2200 MHz

Band	RF port
1695-2200	3-4
698-894	1-2
1695-2200	5-6



700/850 4T4R Macro 320W ORU - New Filter (RF4461d-13A)

SAMSUNG

Specifications



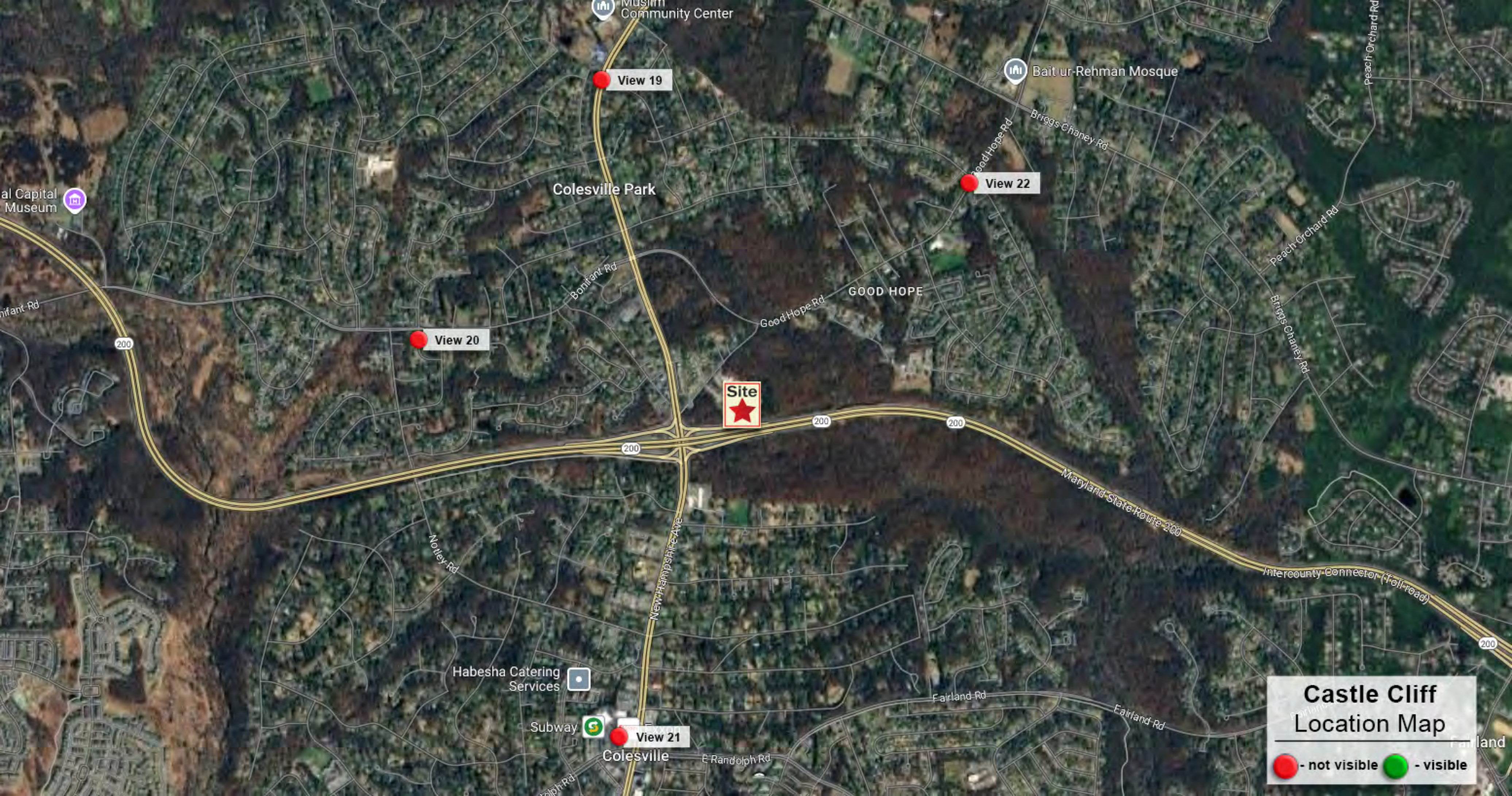
* 5MHz supporting in B13(700MHz) depends on 3GPP std. and UE capability.
External filters in interferer and victim sides for Mexican boarder to support 5MHz service need to be considered
** Finger guard is not needed.

Item	Specification	
Air Interface	LTE, NR(HW resource ready)	
Band	Band13 (700MHz)	Band5 (850MHz)
Frequency	DL: 746~756MHz UL: 777~787MHz	DL: 869~894MHz UL: 824~849MHz
1BW	10MHz	25MHz
OBW	10MHz	25MHz
Carrier Bandwidth	LTE/NR 5*/10MHz	LTE 5/10MHz NR 5/10/15/20MHz
# of carriers	2C*	3C
Total # of carriers	4C + B13 (SDL) 1C	
RF Chain	4T4R/2T4R/2T2R/1T2R 2T2R+2T2R bi-sector Total : 320W	
RF Output Power	4 x 40W or 2 x 60W	4 x 40W or 2 x 60W
Spectrum Analyzer	TX/RX Support	
RX Sensitivity	Typ. -104.5dBm @1Rx (25RBs 5MHz)	
Modulation	256QAM support, (1024QAM with 1~2dB power back-off)	
Input Power	-48VDC (-38VDC to -57VDC)	
Power Consumption	1,165 Watt @ 100% RF load, room temperature	
Size (WHD)	380 x 380 x 260 mm (14.96 x 14.96 x 10.23 inch)	
Volume	37.5 L	
Weight (W/o Solar Shield & finger guard)	35.9 kg (79.1 lb)	
Operating Temperature	-40°C (-40°F) ~ 55°C (131°F) (Without solar load)	
Cooling	Natural convection	
Unwanted Emission	3GPP 36.104	3GPP 36.104
	FCC 47 CFR 27.53 c), f)	FCC 47 CFR 22.917
	-	-69 dBm/100 kHz per path @ 896 ~901MHz
CPRI Cascade	Not supported	
Optic Interface	20km, 2 ports (9.8Gbps x 2), SFP+, single mode, Duplex (Option: Bi-di)	
RET & TMA Interface	AISG 3.0	
Bias-T	4 ports (2 ports per band)	
Mounting Options	Pole, wall	
NB-IoT	2GB+2IB or 4IB	2SA+2GB or 2GB+2IB or 4GB
PIM Cancellation	Support	
# of antenna port	4	
External Alarm	4	
Fronthaul Interface	Opt. 8 CPRI / Opt. 7-2x selectable (not simultaneous support)	
CPRI compression	Not Support	



Castle Cliff Location Map

- not visible - visible



Muslim Community Center

Bait ur-Rehman Mosque

National Capital Museum

Colesville Park

View 22

View 20

Site

GOOD HOPE

200

200

200

Maryland State Route 200

Intercounty Connector (Toll road)

Habesha Catering Services

Subway

View 21

Colesville

E Randolph Rd

Fairland Rd

Fairland Rd

Castle Cliff Location Map

- not visible - visible



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 6-MD Route 200
View from the Southeast
Located .10 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 7-New Hampshire Avenue
View from the Northwest
Located .25 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 8-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 9-Cape May Road
View from the West
Located .16 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 10-Bonifant Road &
New Hampshire Avenue
View from the Northwest
Located .52 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 11-Good Hope Road &
Cape May Road
View from the North
Located .24 miles from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 12-Good Hope Road
View from the Northeast
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 13-New Hampshire Avenue
View from the Northeast
Located .41 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 14-Amberleigh Drive
View from the West
Located .48 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 15-Amberleigh Drive
View from the West
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 16-Colesville Manor Drive
View from the Southwest
Located .43 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 17-Hobbs Drive
View from the Southwest
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 18-Hobbs Drive
View from the South
Located .34 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 19-New Hampshire Avenue &
Southview Avenue
View from the Northwest
Located 1 mile from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 20-Sandy Ridge Road
View from the West
Located .93 miles from Tower Site
SITE NOT VISIBLE






Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 21-Colesville Shopping Center
View from the Southwest
Located 1 mile from Tower Site
SITE NOT VISIBLE

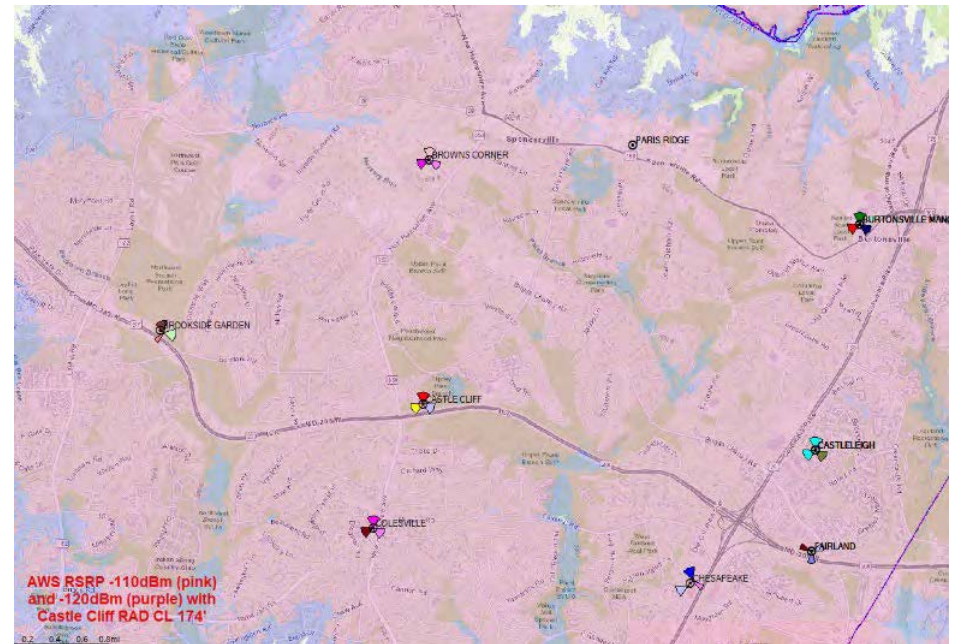
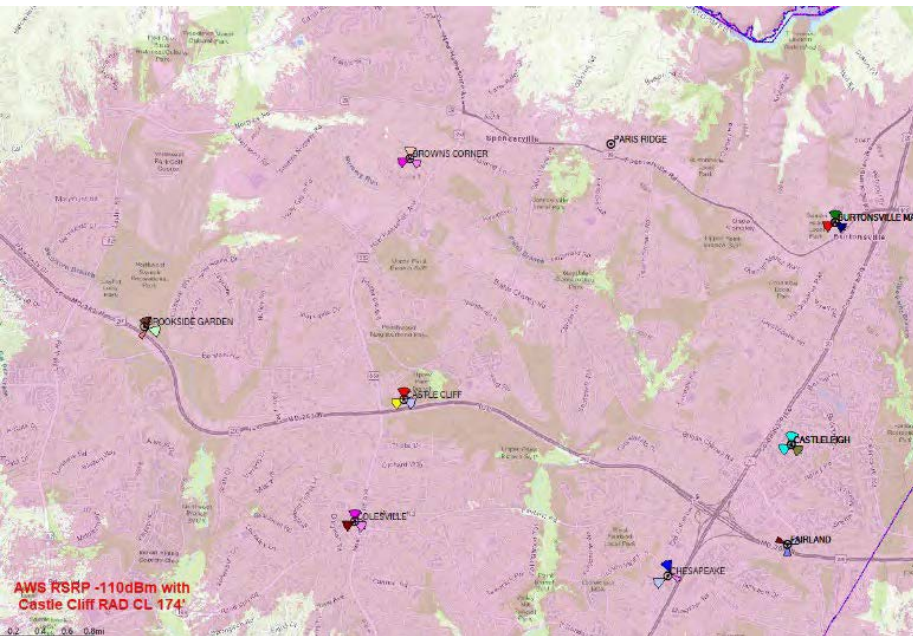
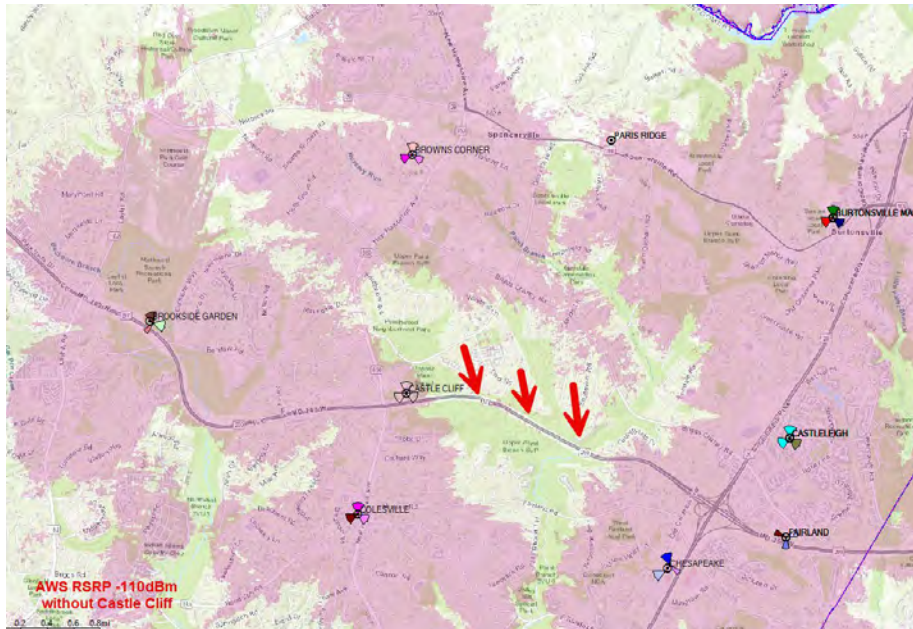


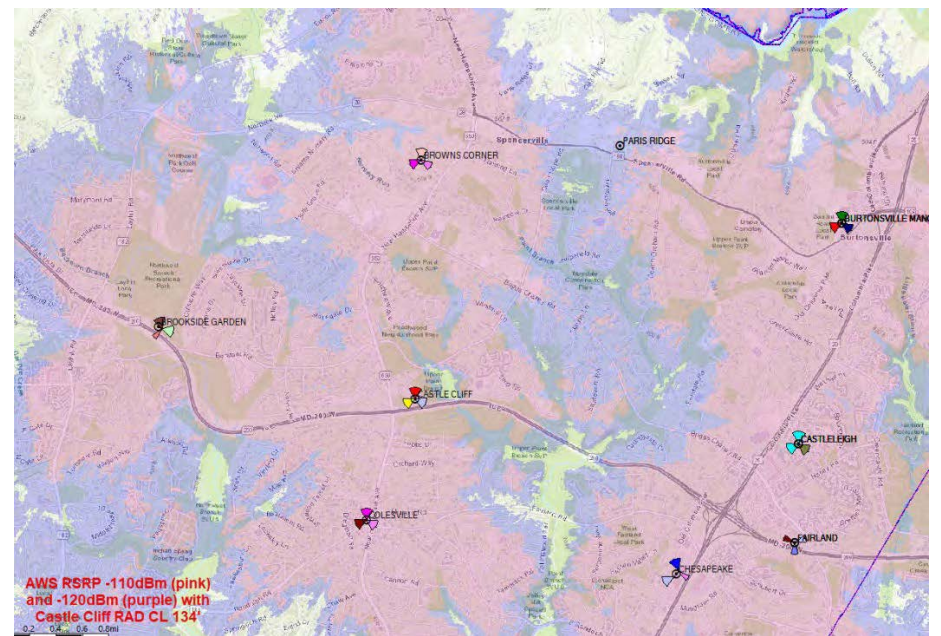
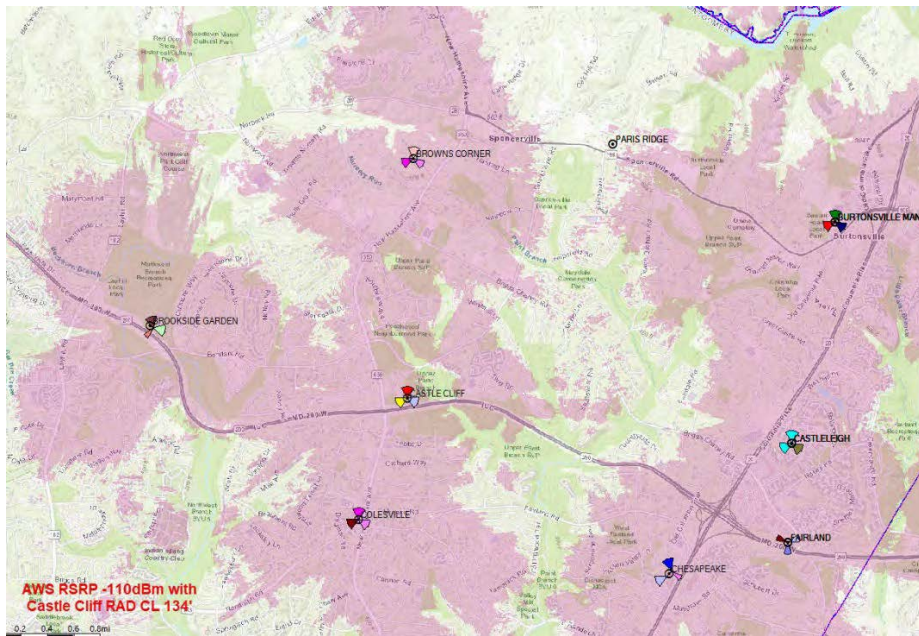
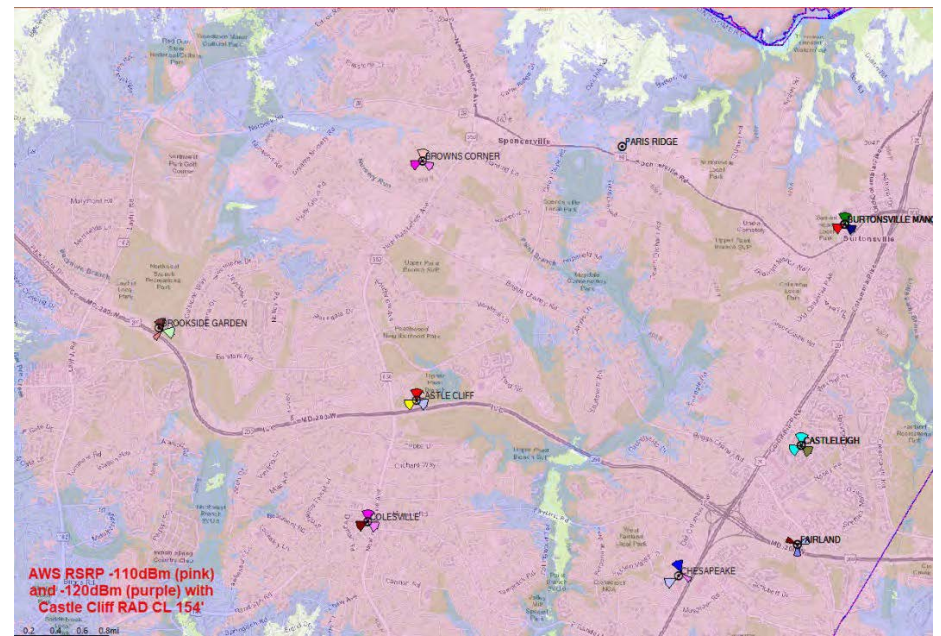
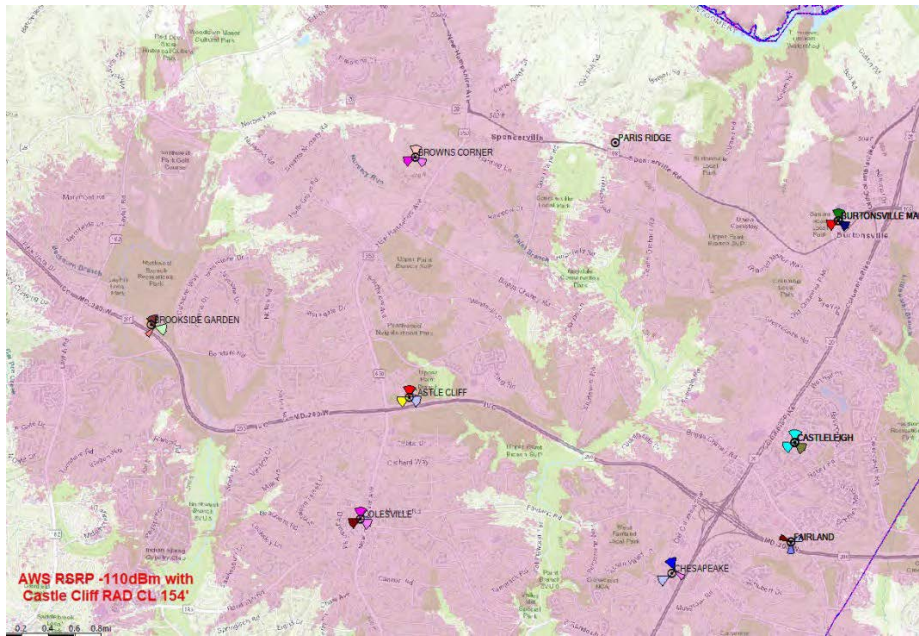


Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 22-Good Hope Road &
Windmill Lane
View from the Northeast
Located .90 miles from Tower Site
SITE NOT VISIBLE







MILLENNIUM ENGINEERING, P.C.

42 Old Barn Drive
West Chester, Pennsylvania 19382

Cell: 610-220-3820
www.millenniumeng.com

Email: pauldugan@comcast.net

January 27, 2025

Attn: Jim Golden, Director- Strategic Programs
Network Towers II, LLC
6095 Marshalee Drive, Suite 300
Elkridge, MD 21075

Re: RF Safety FCC Compliance of Proposed Communications Facility

Site Name: Castle Cliff, Proposed 179' Monopole

Site Address: 14335 Cape May Road, Silver Springs, MD 20904 (Montgomery County)

Latitude 39° 05' 23.388" N, Longitude 76° 59' 46.482" W (NAD83), G.E. 454' +/- A.M.S.L.

Dear Mr. Golden,

I have performed an analysis to provide an independent determination and certification that the proposed Verizon Wireless communications facility at the above referenced property will comply with Federal Communications Commission (FCC) exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields (Code of Federal Regulation 47 CFR 1.1307 and 1.1310). As a registered professional engineer, I am under the jurisdiction of the State Registration Boards in which I am licensed to hold paramount the safety, health, and welfare of the public and to issue all public statements in an objective and truthful manner.

The proposed communications facility consists of a new 179' monopole at the above referenced property. The proposed antenna configuration consists of 9 total antennas (3 per sector) as follows:

- (6) multiband directional panel antennas (JMA Wireless MX06FHG865-HG or equivalent), (2) per sector at a centerline of 174 ft, azimuth of 5-115-240; transmitting from these antennas will be (1) 700 MHz LTE wideband channel, (1) 850 MHz LTE & 5G wideband channel, (1) 1900 MHz LTE wideband channel, (1) AWS 2100 MHz LTE wideband channel, and (2) AWS3 2100 MHz LTE wideband channels
- (3) LS6 5G panel antennas (Samsung MT6413-77A or equivalent), (1) per sector at a centerline of 174; azimuth of 5-115-240; transmitting from these antennas will be (1) LS6 3700 MHz 5G wideband channel; actually two adjacent channel blocks A 3800-3900 and B 3900-3960 MHz

The following assumptions are made for reasonable upper limit radiofrequency operating parameters for the proposed facility due to the Verizon Wireless antennas alone:

- (2) 700/850/1900/2100/3500 MHz (LTE) multiband directional transmit antennas per sector
- (1) 3700 MHz 5G directional transmit antenna per sector
- (1) 700 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 850 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 1900 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain

- (1) 2100 MHz LTE AWS wideband channel at 4X40W max power/face before cable loss/antenna gain
- (2) 2100 MHz LTE AWS3 wideband channels at 4x40W max power/face before cable loss/antenna gain
- (1) 3700 MHz 5G wideband channel at 320W max power/face before cable loss/antenna gain
- The facility would be at or near full capacity during busy hour

ERP Calculation

700: 4X40W = 160W = 52 dBm + 17.1 dB = 69.1 dBm = 8128W ERP

850: 4X40W = 160W = 52 dBm + 17.3 dB = 69.3 dBm = 8511W ERP

1900: 4X40W = 160W = 52 dBm + 19.2 dB = 71.2 dBm = 13183W ERP

2100: 4X40W = 160W = 52 dBm + 19.7 dB = 71.7 dBm = 14791W ERP

3500: 8X40W = 320W = 55 dBm + 19.9 dB = 74.9 dBm = 30903W ERP

Note: the above ERP calculation is total ERP across each entire band and does not break down into W/MHz

Using the far-field power density equations from FCC Bulletin OET 65, the power density at any given distance from the antennas is equal to $0.360(ERP)/R^2$ where R is the distance to the point at which the exposure is being calculated. The given equation is a conversion of the OET 65 power density equation for calculating power density given the distance in feet and the result in metric units (mW/cm^2). This calculated power density assumes the location is in the main beam of the vertical pattern of the antenna. After making an adjustment for the reduction in power density due to the vertical pattern of the transmit antenna, the calculated ground level power density is well below 1 % of the FCC general population exposure limit at any distance from the antenna system of Verizon Wireless.

The 700 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $500 \mu W/cm^2$ or $0.5 mW/cm^2$. The 850 MHz transmit frequencies, which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $587 \mu W/cm^2$ or $0.587 mW/cm^2$. The 1900 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 2100 MHz which Verizon Wireless is also licensed by the FCC to operate, have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 3700 MHz C-Band transmit frequencies have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$.

Therefore, the exposure at ground level at any distance from the structure would be substantially below 1 % of the FCC general population exposure limits due to Verizon Wireless antennas alone. The extremely low ground exposure levels are due to the elevated positions of the antennas in the structure and the low power which these systems operate. See Figures 1 and 2 in back of this report which discusses the relationship between height, proximity or distance, and orientation to level of electromagnetic field exposure.

In summary, the proposed communications facility will comply with all applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65). Federal law (FCC Rule Title 47 CFR 1.1307 and 1.1310) sets the national standard for compliance with electromagnetic field safety. The FCC exposure limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) and, over a wide range of frequencies, the exposure limits developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI). **Thus, there is full compliance with the standards of the IRPA, FCC, IEEE, ANSI, and NCRP.**

General Information on Electromagnetic Field Safety

Verizon Wireless facilities transmit and receive low power electromagnetic fields (EMF) between base station antennas and handheld devices (smart phones, ipads, laptops, jetpacks, etc.). The radiofrequency energy from these facilities and devices is non-ionizing electromagnetic energy. Non-ionizing, unlike X-Rays or other forms of potentially harmful energy in the microwave region, is not cumulative over time nor can the energy change the

chemical makeup of atoms (e.g. strip electrons from ions). “Non-ionizing” simply means that the energy is not strong enough to break ionic bonds.

Safe levels of electromagnetic fields were determined by numerous worldwide organizations, such the International Committee for Non-Ionizing Radiation Protection, a worldwide multi-disciplinary team of researchers and scientists studying the effects of non-ionizing radiofrequency energy such as that emitted by base stations or cell phones. The FCC did not arbitrarily establish their own standards, but rather adopted the recommendations of all leading organizations that set standards and research the subject such as the Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), and National Council on Radiation Protection and Measurements (NCRP).

When Verizon Wireless, or any commercial wireless communications licensee, is located on an antenna structure such as a self-supporting lattice type tower, monopole, guyed tower, watertank, etc. the antennas are typically 10 meters or more above ground level (10 meters = 32.81 feet). With the relatively low power and elevated positions of the antennas on the structure with respect to ground level, the maximum ground level exposure can rarely approach 1 % of the applicable FCC exposure limit regardless of how many sets of antennas are collocated on the structure. For this reason, the FCC considers the facilities “categorically excluded” from routine evaluation at antenna heights above 10 meters (or above 32.81 feet). Categorical exclusion exempts a site from routine on-site evaluation. However, the facility is not excluded from compliance with the federal exposure limits and guidelines. The types of facilities used by Verizon Wireless typically elevated on antenna structures (away from access to close proximity, i.e. greater than 10 meters or 32.81 feet) simply cannot generate ground level exposure levels that approach the limits under any circumstances.

From a regulatory perspective, the FCC has sole jurisdiction over the regulation of electromagnetic fields from all facilities and devices. The FCC has established guidelines and limits over emissions and exposure to protect the general public. The FCC also has certain criteria that trigger when an environmental evaluation must be performed. The criteria are based on distance from the antennas (accessibility) and transmit power levels.

CONCLUSIONS:

- 1) The proposed Verizon Wireless communications facility will comply with electromagnetic field safety standards by a substantial margin (well below 1 %) in all publicly accessible areas. This includes the base of the proposed structure and any areas in proximity to the structure.**
- 2) Verizon Wireless takes appropriate measures to ensure that all telecommunications facilities (including this proposed facility) comply with applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65).**
- 3) In cases where such compliance exists, the subject of electromagnetic field safety is preempted.** The Telecommunications Act of 1996 states that: “No state or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [FCC’s] regulations concerning such emissions.” Telecommunications Act of 1996, § 332[c][7][B][iv].

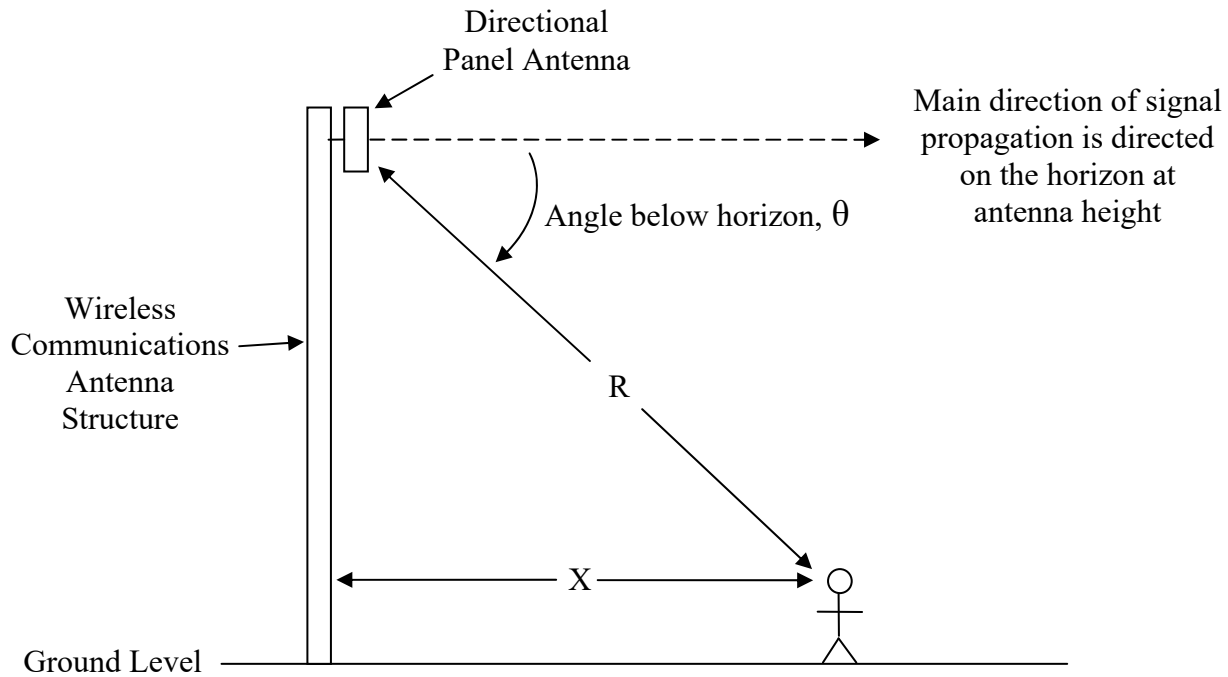
Respectfully,



Paul Dugan, P.E.
Registered Professional Engineer
Maryland License Number 24211

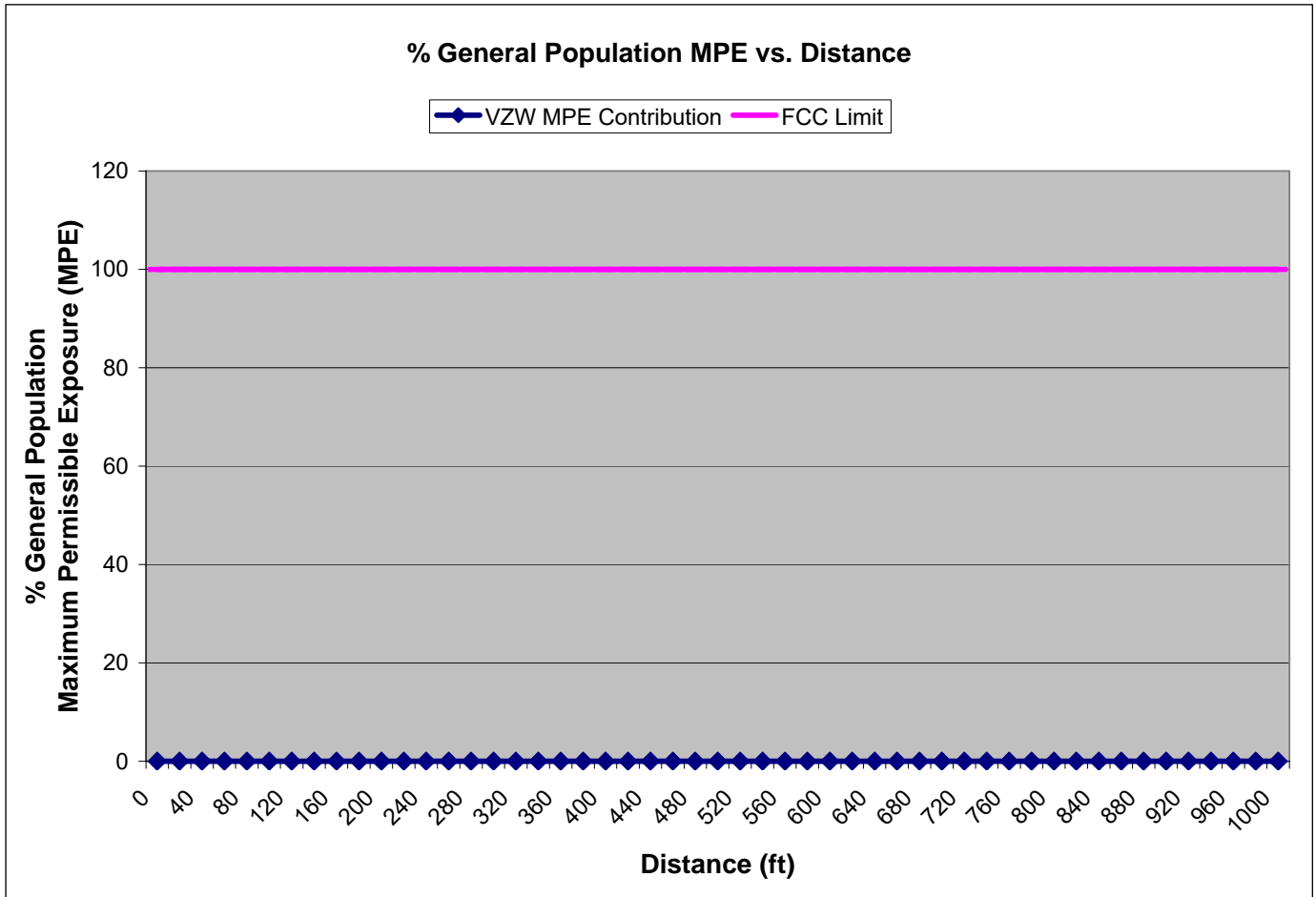


FIGURE 1: Diagram of Electromagnetic Field Strength as a Function of Distance and Antenna Orientation



The above diagram illustrates the conceptual relationship of distance and orientation to directional panel antennas used in wireless communications. At the base of the structure ($x = 0$), the distance R is a minimum when the angle of the direction of propagation θ is a maximum. As one moves away from the antenna structure, the horizontal distance X increases as well as the distance R to the antennas while the angle below the horizon decreases. For this reason, electromagnetic fields from these facilities remain fairly uniform up to a few hundred feet and continue to taper off with distance. As noted in the report, the electromagnetic fields from these types of facilities are hundreds of times below safety standards at any distance from the antenna structure, making them essentially indistinguishable relative to other sources of electromagnetic fields in the environment due to the elevated heights of the antennas and the relatively low power at which these systems operate.

FIGURE 2: Graph of MPE Contribution vs. Distance



The above graph represents the contribution of VZW to the composite electromagnetic field exposure level at any distance from the base of the structure. The contribution of VZW will remain well under 1% of the FCC general population maximum permissible exposure (MPE) at any distance as shown.

DECLARATION OF ENGINEER

Paul Dugan, P.E., declares and states that he is a graduate telecommunications consulting engineer (BSE/ME Widener University 1984/1988), whose qualifications are a matter of record with the Federal Communications Commission (FCC). His firm, Millennium Engineering, P.C., has been retained by Network Towers II LCC to perform power density measurements or calculations for an existing or proposed communications facility and analyze the data for compliance with FCC exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields.

Mr. Dugan also states that the calculations or measurements made in the evaluation were made by himself or his technical associates under his direct supervision, and the summary letter certification of FCC compliance associated with the foregoing document was made or prepared by him personally. Mr. Dugan is a registered professional engineer in the Jurisdictions of Pennsylvania, New Jersey, Delaware, Maryland, Virginia, New York, Connecticut, District of Columbia, West Virginia, Puerto Rico, and Colorado with 40 years of engineering experience. Mr. Dugan is also an active member of the Association of Federal Communications Consulting Engineers, the National Council of Examiners for Engineering, the National Society of Professionals Engineers, the Pennsylvania Society of Professional Engineers, and the Radio Club of America. Mr. Dugan further states that all facts and statements contained herein are true and accurate to the best of his own knowledge, except where stated to be in information or belief, and, as to those facts, he believes them to be true. He believes under penalty of perjury the foregoing is true and correct.


Paul Dugan, P.E.

Executed this the 27th day of January, 2025.

PAUL DUGAN, P.E.
42 Old Barn Drive
West Chester, PA 19382
Cell: 610-220-3820
Email: paul.mepc@gmail.com
Web Page: www.millenniumeng.com

EDUCATION: Widener University, Chester, Pennsylvania
Master of Business Administration, July 1991
Master of Electrical Engineering, December 1988
Bachelor of Science, Electrical Engineering, May 1984

PROFESSIONAL ASSOCIATIONS: **Registered Professional Engineer** in the following jurisdictions:

Pennsylvania, License Number PE-045711-E
New Jersey, License Number GE41731
Maryland, License Number 24211
Delaware, License Number 11797
Virginia, License Number 36239
West Virginia, License Number 20258
Connecticut, License Number 22566
New York, License Number 079144
District of Columbia, License Number PE-900355
Puerto Rico, License Number 18946
Colorado, License Number PE.0065295

Full member of **The Association of Federal Communications Consulting Engineers**
(www.afcce.org) January 1999 to Present

Elected and served on the Board of Directors for five year term 2006-2011

Full member of **The National Society of Professional Engineers** (www.nspe.org) and the **Pennsylvania Society of Professional Engineers** (www.pspe.org) June 2003 to Present
Currently serving as PSPE State Director and Past President on the Board of Directors of the Valley Forge Chapter and the South East Region Vice-Chair for the "Professional Engineers in Private Practice" Executive Committee. Actively participated in NSPE Annual Conferences 7/2005 to Present.

Actively participate in **Chester County ARES/RACES Amateur Radio** (CCAR www.w3eoc.org) which prepares and provides emergency backup communications for Chester County Department of Emergency Services, March 2005 to Present

Full member of **The National Council of Examiners for Engineering**
(www.ncees.org) May 2001 to Present

Full Member of **The Radio Club of America**
(www.radio-club-of-america.org) December 2003 to Present

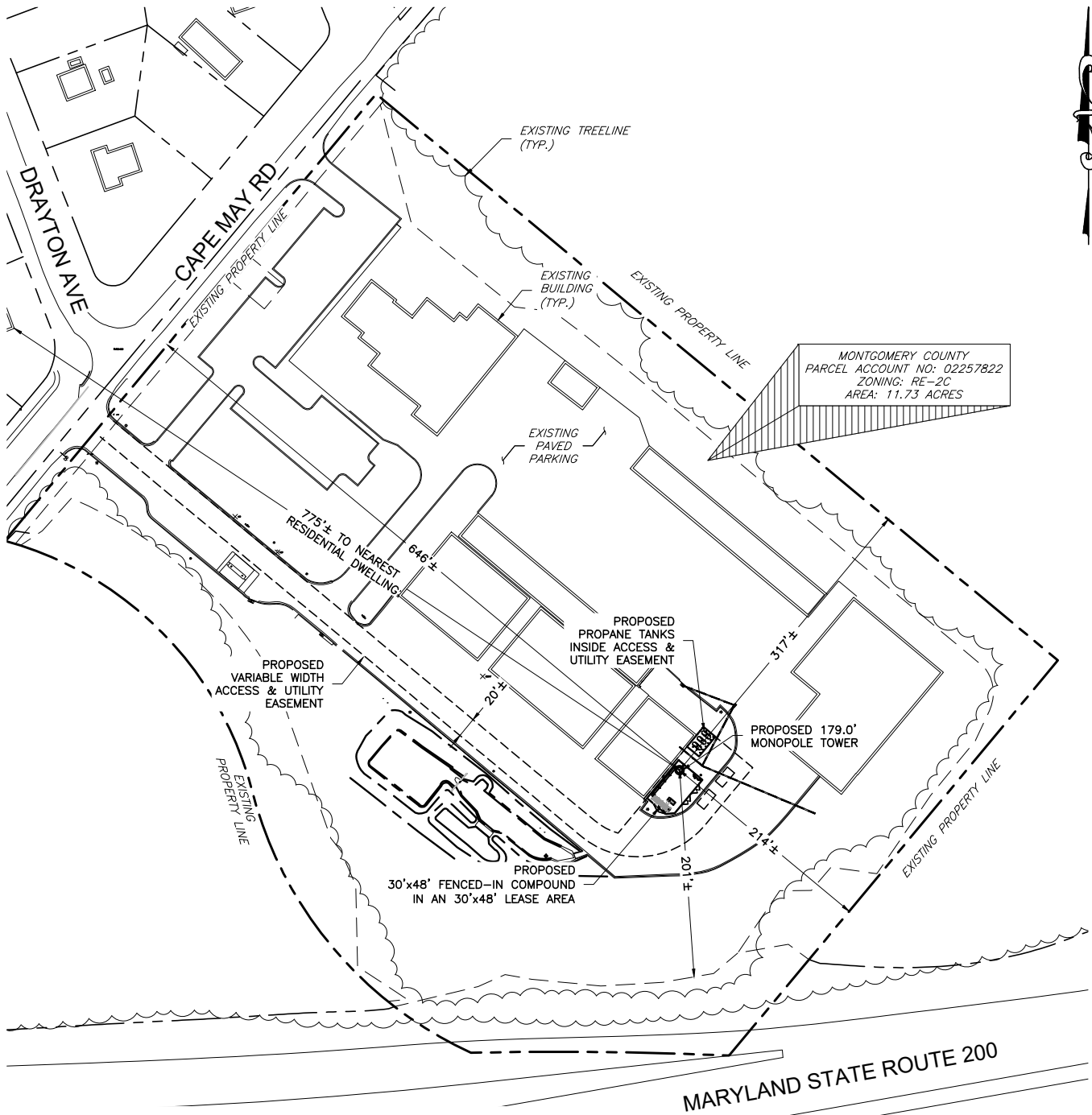
Pennsylvania Real Estate License Number RS347405 Keller Williams 2/2019 to Present

PROFESSIONAL EXPERIENCE: Millennium Engineering, P.C., West Chester, Pennsylvania
Position: **President**, August 1999 to Present (www.millenniumeng.com)

Verizon Wireless, Plymouth Meeting, Pennsylvania
Position: **Cellular RF System Design/Performance Engineer**, April 1990 to August 1999

Communications Test Design, Inc., West Chester, Pennsylvania
Position: **Electrical Engineer**, May 1984 to April 1990

PERSONAL: Date/place of birth: November 21, 1961, West Chester, Pennsylvania; United States Citizen



MONTGOMERY COUNTY
PARCEL ACCOUNT NO: 02257822
ZONING: RE-2C
AREA: 11.73 ACRES

PROPERTY INFORMATION

OWNER: MONTGOMERY COUNTY
OWNER ADDRESS: EOB 101 MONROE ST
ROCKVILLE, MD 20850
PARCEL ID: 02257822
ZONING: RE-2C
AREA: 11.73 ACRES

PROPERTY PLAN



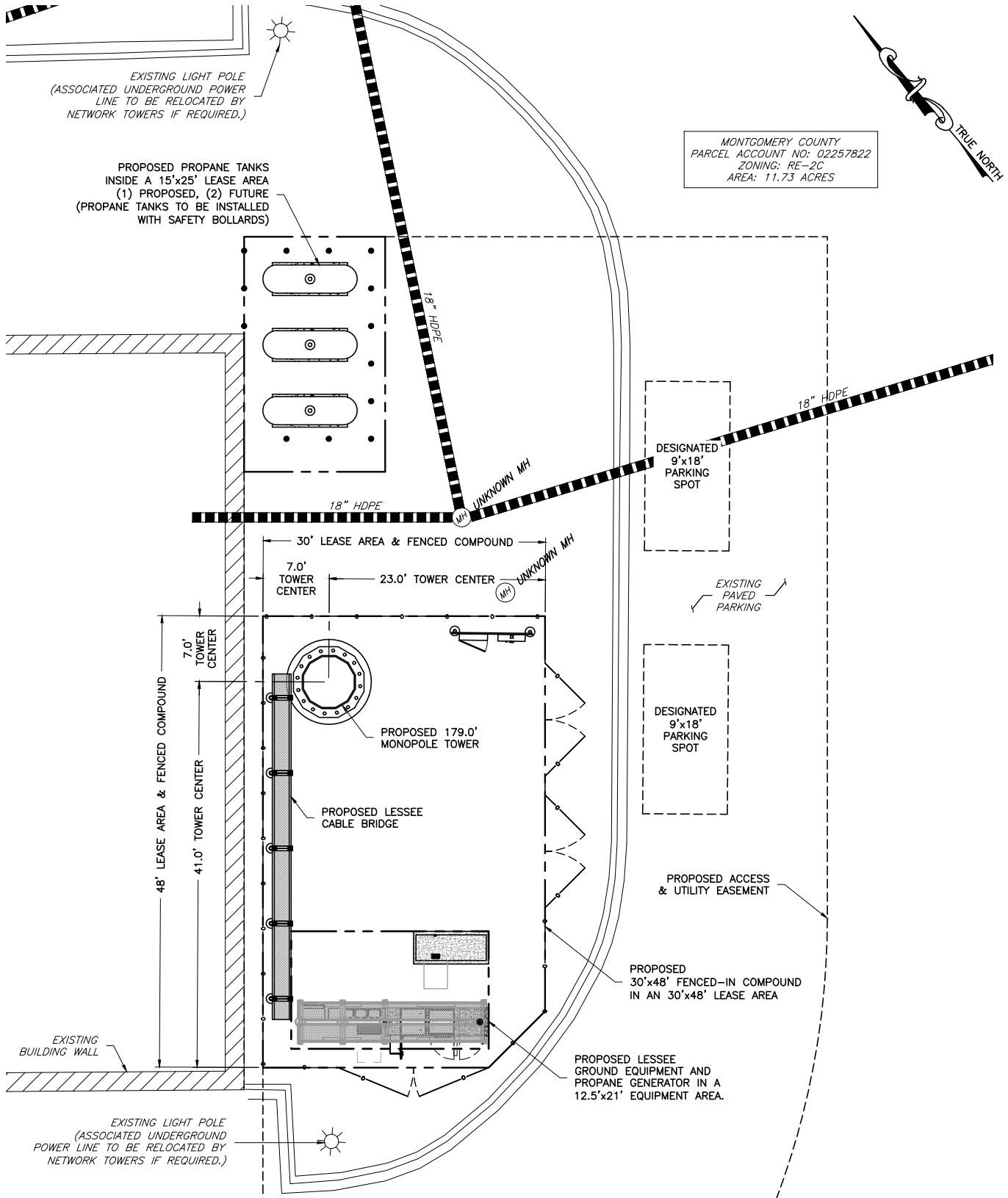
"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -
LAT (NAD 83): 39.0897°
LONG (NAD 83): -76.9962°

SHEET 1

01/23/2025
BY: OP



COMPOUND PLAN



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

SHEET 2

01/23/2025
BY: OP

PROPOSED LESSEE ANTENNAS
(2) JMA WIRELESS MX06FHG865-HG PER SECTOR, (6) TOTAL
(1) SAMSUNG MT6413-77A PER SECTOR, (3) TOTAL

LESSEE TOWER SPACE
179' AGL TO 167' AGL

PROPOSED
179' MONOPOLE

PROPOSED TOP OF MONOPOLE
ELEV.= 179.0' AGL
CARRIER ANTENNA RAD. CENTER
ELEV.= 174.0' AGL

PROPOSED
FENCED COMPOUND

EXISTING GRADE
ELEV.= 0.0' AGL

ELEVATION



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRING, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

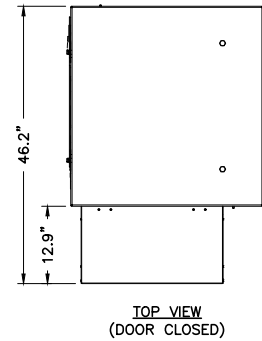
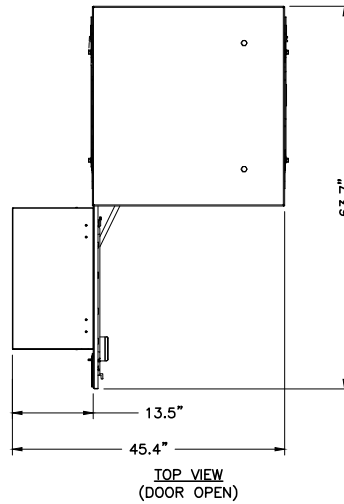
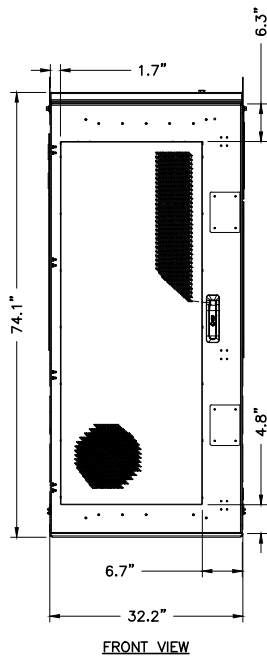
SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

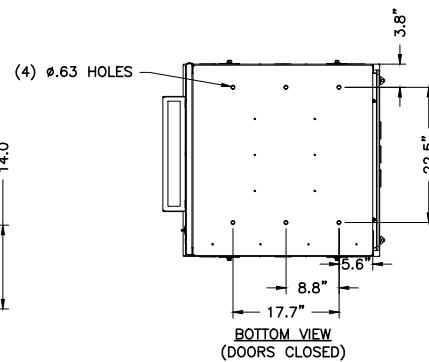
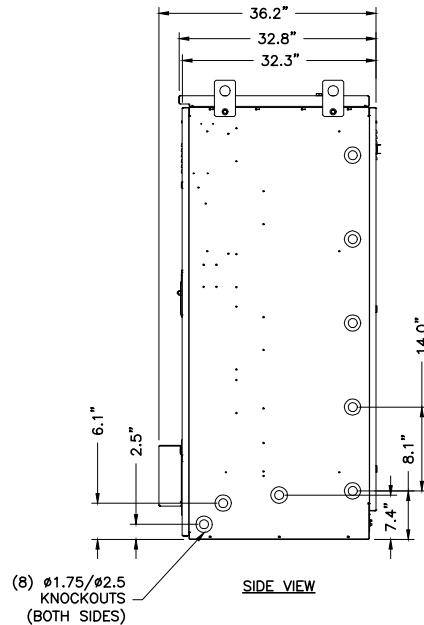
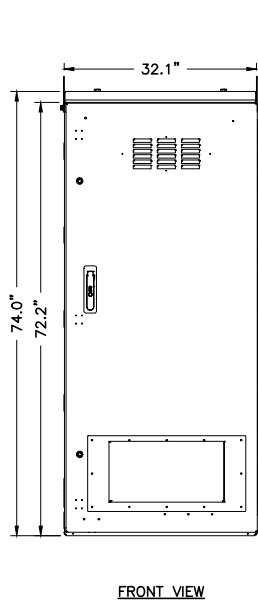
SHEET 3

**01/23/2025
BY: OP**



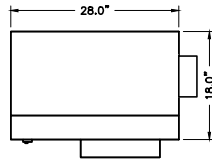
SPECIFICATIONS:
 HEIGHT: 74.1"
 WIDTH: 32.2"
 DEPTH: 46.2"
 WEIGHT: 450 LBS (EMPTY)

1 **CHARLES CABINET CUBE-PM63912TN1 DETAIL**
 NOT TO SCALE



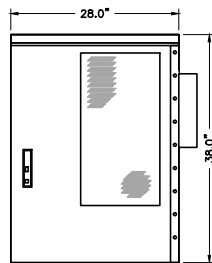
SPECIFICATIONS:
 HEIGHT: 74.1"
 WIDTH: 32.1"
 DEPTH: 36.2"
 WEIGHT: 900 LBS (EMPTY)

2 **CHARLES LT-BB24/BB48 BATTERY CABINET**
 NOT TO SCALE

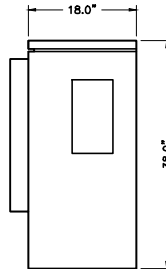


TOP VIEW

SPECIFICATIONS
 MANUFACTURER: CHARLES INDUSTRIES
 HEIGHT: 38.0 IN
 WIDTH: 28.0 IN
 DEPTH: 18.0 IN

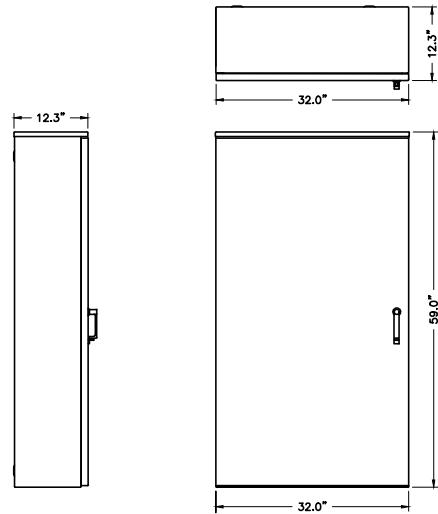


FRONT VIEW

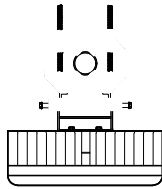


SIDE VIEW

4 CHARLES CUBE DETAIL
 C-4 NTS



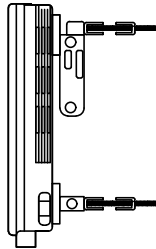
3 ASCO D300L INTEGRATED LOAD CENTER
 C-4 NTS



TOP VIEW

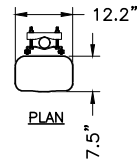
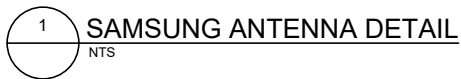


FRONT VIEW



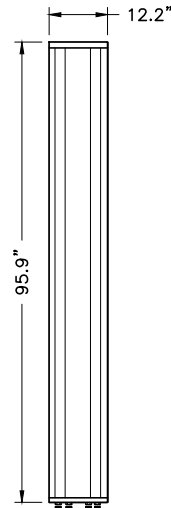
SIDE VIEW

MODEL #	HEIGHT	WIDTH	DEPTH	WEIGHT W/O BRACKET
MT6413-77A	28.9"	15.8"	5.51"	57.32 LBS

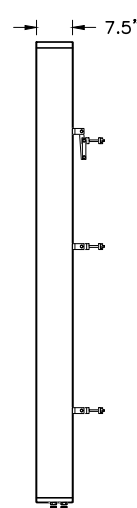


PLAN

ANTENNA WEIGHT:
51.0 LBS

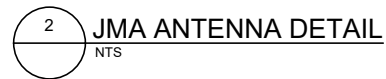


ELEVATION



SIDE

MODEL #	HEIGHT	WIDTH	DEPTH	WEIGHT W/O BRACKET
MX06FHG865-HG	95.9"	12.2"	7.5"	51.0 LBS





DEPARTMENT OF GENERAL SERVICES

Marc Elrich
County Executive

David Dise
Director

December 6, 2024

To Whom It May Concern,

Montgomery County, Md is the fee simple owner of 14335 Cape May Rd, Silver Spring, MD 20904, a 11.73 Acre Parcel that is the home of the County's Colesville Maintenance Depot. The property ID is **District - 05 Account Number – 02257822**.

This letter hereby authorizes Network Towers II, LLC and Drew Patterson or Jim Golden, as authorized signatures, to sign and file any and all application documents, files and plans for the purpose of zoning, permitting and construction of a proposed wireless tower at this location.

This authorization includes preparing applications, plans, permits and all related materials needed to support the filing and processing of the applications and all supporting materials with the applicable governmental bodies.

Sincerely,

Greg Ossont
Deputy Director



December 12, 2024

Network Towers II, LLC
120 Eastshore Drive, Suite 300
Glen Allen, VA 23059

Re: Letter of Intent
New Tower at Colesville Maintenance Depot
14335 Cape May Road Silver Spring, MD 20904
AT&T Site Name: Tamarack (Site ID: 12922574)

To Whom It May Concern:

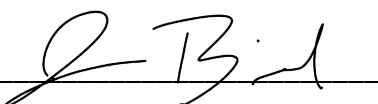
New Cingular Wireless PCS, LLC (AT&T) has engaged Smartlink Group to represent AT&T for all zoning, permitting, and other necessary governmental approvals needed for the AT&T site "Tamarack".

This letter hereby serves as a letter of intent that AT&T will co-locate on the tower proposed by Network Towers II, LLC, once installed.

It is AT&T's intention to co-locate on the tower to provide better coverage along Route 200.

Thank you for your attention to this matter.

Sincerely,

Signature: 

By: Jesse Bird

Its: Principle Tech Vendor Mgmt



December 12, 2024

Jim Golden
Network Building & Consulting
6095 Marshalee Drive, Suite 300
Elkridge, MD. 21075

Re: Castle Cliff - Proposed New Tower at 14335 Cape May Rd., Silver Spring, MD.

20904

Dear Mr. Golden:

T-Mobile, an FCC Licensed Cellular provider in the State of Maryland, is expressing its interest in leasing a proposed communication site called Castle Cliff.

T-Mobile has designed and constructed its wireless network in the Baltimore/Washington area. In order to maintain superior service, we continue to consider opportunities which will improve the network. This proposed location called Castle Cliff will enhance T-Mobile's wireless coverage in the surrounding areas.

This letter is only an expression of interest. The parties shall not be contractually bound unless and until they execute a formal lease, which must be in the form and content satisfactory to each party in their sole discretion. Neither party may rely on this letter as creating any legal obligation of any kind.

Sincerely,

Patrick Riordan

Patrick Riordan

Sr. Manager, Development | DC Eng & Ops

T-Mobile US, Inc.

12050 Baltimore Ave Suite 100, Beltsville, MD
20705

Mobile: (717) 645-9523

Email: patrick.riordan1@t-mobile.com

App No:

2024112367

Application General Information

Applicant Name	Network Towers II, LLC	Received	12/17/2024
Application Type	New	Ann. Plan?	Yes
Carrier	Verizon Wireless	Will site be used to support government telecommunications facilities or other equipment for government use?	No
Solution Type	Macro		
Existing	New		
		Gvt. Use Desc.	

Application Description

This application is for a new 179' monopole at 14335 Cape May Road, Silver Spring, MD. 3 Carriers are interested in locating on this structure. Verizon is the lead carrier. Our company, Network Towers II, LLC will own, operate and maintain the structure and compound. Montgomery County, MD is the landlord.

Site Information

Site Id		Zoning	Detached Residential
Structure Type	Monopole	Latitude	39.0897
Street Address	14335 Cape May Road	Longitude	-76.9962
County Site Name	Colesville Depot	Ground Elevation	454
Carrier Site Name	Castle Cliff	City	Silver Springs
Site Owner	Montgomery County	Lease Status	In Process
Structure Owner	To Be built Tower- Network Towers II	Does the structure require an antenna structure registration under FCC Title 47	No
Existing Structure Height	454	Distance to Residential Property (New, Colocation Only)	775
Provide the proposed height of the new structure without any antenna (New Apps Only)		Distance to Commercial Property (New, Colocation Only)	1143

Justification of why this site was selected:

This search ring has been worked on by all 3 major carriers over the last 10 plus years. All 3 are have committed to colocate on this structure if built. This site borders the ICC Route. Approximately 60,000 cars ravel on this highway daily. The location is >95% residential or Parklands. There was over 25 locations reviewed. This is the most commercial property that could work.

NearbySites (New Apps Only):

See list of alternate sites considered on next page.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

Screening considerations(New, Colocation Apps Only):

The site will be occupied by at least 3 carriers and is projected to be a 178' monopole. The Colesville Depot site is a Montgomery County Maintenance yard with heavy equipment, road salt storage, with moderate to heavy traffic going in and out. The site is surrounded by trees on 3 sides and borders the ICC on the south side. Due to the limited commercial or industrial sites in the area- this site is located in the rear of the site- but allows for a 1:1 setback from the ICC side property line. The closest residential property is 775' away to the NNW. Our balloon test consisted of 22 locations. Only 4 were visible. None were visible from 1 mile away.

Nearby Alternate Sites Considered:

1. Good Hope United Methodist Church- 14680 Good Hope Rd Silver Spring MD- Church board voted against tower
2. Charles Drew Elementary School- 1200 Swingingdale Dr Silver Spring MD- No Interest- Safety Concerns
3. Colesville Local Park/ MD child services- 610 Hobbs Dr Colesville Md- Montgomery County Parks made determination that location was not suitable for a tower
4. Peach Wood Park- 39.097184, -76.996847- Montgomery County Parks made determination that location was not suitable for a tower
5. Good Hope Community Center- 14715 Good Hope Rd Silver Spring MD- Montgomery County denied the tower at the community center
6. Good Hope Local Park- 39.096295, -76.984786- Montgomery County Parks deemed that the location was not suitable for a tower
7. Washington Zion Presbyterian Church- 14655 Good Hope Rd Silver Spring Md- No interest
8. MDOT Property on ICC- 39.08984/-76.9867- MDOT rejected due to safety concerns
9. Transfiguration Church- 13925 New Hampshire Ave Silver Spring Md- Interested in Raw land but not much room and tough zoning case with setbacks and Just out of search ring
10. Fire Alliance Church- 14500 New Hampshire Ave Silver Spring Md- Currently Tmobile in Steeple- only 40' high. Landlord is open to Rawland but said they have future plans for property where tower could go - outside of search ring
11. Heyser Farms- 14526 New Hampshire Ave Silver Spring Md- Landlord not interested and Out of search ring
12. MDOT Location along the Highway- 39.089421, -76.983101- rejected by MDOT.

Wednesday, December 18, 2024

7:49:12 PM

App No:

2024112367

6409 Questions

Does this qualify as a 6409 application? (Minor Mod, Colocations Only)

For towers outside the public ROW will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 20 feet, whichever is greater?

Will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 6 feet?

For towers outside the public ROW will the proposed installation increase the width by adding appurtenance to the body of the structure that would protrude from the edge of the structure by more than 20 feet?

Will the proposed installation require more the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets?YN

Will the proposed installation increase the height of the structure by: (1) more than 10% or (2) more than 10 feet, whichever is greater?

Does the structure or current installation have concealment elements/measures?

No

Will the proposed installation require excavation or expansion outside the current boundaries of the site?

If yes, describe how the proposed installation does not defeat the existing concealment.

Small Wireless Facility Information

Small Wireless Facility Questions

Small Wireless Facility?

No

Is the structure 10% taller than adjacent structures?

Yes

Cumulative volume of the proposed wireless equipment(s) exclusive of antennas in cubic feet

Please list adjacent structure heights

Cumulative volume of the proposed antenna(s) exclusive of equipment in cubic feet

Tribal Lands?

No

ROW Information

PROW?

No

Pole Number

N/A

ROW owner

ROW width

Wednesday, December 18, 2024

7:49:12 PM

App No: 2024112367

Antenna Information

Antenna Compliance	Yes
Compliance Desc	
Antenna Location	Yes
Antenna Loc. Desc.	
Env. Assessment	
Cat. Excluded?	checked
Routine Env. Evaluation	

Antenna Model	JMA MX06FHG865-HG						
Frequency	746-2180 MHZ						
RAD Center	171	Max ERP	540	Antenna Dimensions	96"x12.2"x7.5"	Quantity	9



International
Maryland Fence

GOO

Flonne Professional Hair Braiding

Heyser Farms, Inc

Spring Bunnies Family Home Daycare

CITGO AT ICC

Castle Cliff Monopole

14335 Cape May Rd

McCo Colesville Depot

200

200

Quality Insulation

Colesville Manor Dr

Casa De Montessori

Image NASA

Colesville Local Park

778 ft

Hobbs Dr

Hobbs Dr

lat 39.106765° lon -77.016150° elev

102 MMU Product Specification

for MT6413-77A

Describes the product components, physical nature, functions, specifications, ports, and LED information, and their characteristics as a reference for installation and O & M activities.

© 2023 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

70315

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

TIMS@sea.samsung.com

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	viii
	Personal and Product Safety	ix
	Equipment Markings	xiii
Chapter 1	Introduction	1
	Overview	1
	Functional Description	3
	<i>Clock</i>	3
	<i>Cooling</i>	3
	Specifications	4
Chapter 2	External Interface	6
	Port Information	6
	LED Operation	7
Appendix	Acronyms	9

70315

List of Figures

Figure 1. MT6413-77A Appearance 1

Figure 2. Block Diagram 3

Figure 3. MT6413-77A Port Information..... 6

Figure 4. MT6413-77A LED Information 7

70315

List of Tables

Table 1. Name and Description of Units 2

Table 2. Specifications of the MT6413-77A 4

Table 3. MT6413-77A Port Information..... 6

Table 4. SYS LED 7

Table 5. OPT LED 8

Table 6. PWR LED 8

70315

Preface

This document describes the MT6413-77A of Massive MIMO Unit (MMU) in a 5G network.

The document provides information useful to network operators during the installation, operation, and management cycles. It includes information such as the radio unit functions, hardware configuration, ports, and LED information.



Some hardware configurations are not supported by all software releases or approved for all markets.

Relevance







This manual applies to the following products/software.

Name	Type
MT6413-77A (3.7 GHz)	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`.
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STS**, **eutran-cell-conf-idle**, or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	February 2023	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the hardware overview, functional description, and general specification of the product.
Chapter 2	External Interface	This chapter describes the external interfaces of the radio unit in detail.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 101 5G gNB System Description
- 201 5G gNB Dimensioning and Configuration Manual
- 310 MMU Installation Manual for MT6413-77A

70315

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by UL 62368-1. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under UL 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed in order to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with UL 62368-1, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of UL 62368-1 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery.

End-of-life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California, USA.

‘Perchlorate Material-special handling may apply; see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

70315

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose of it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

MMU should be grounded.

Chapter 1 Introduction

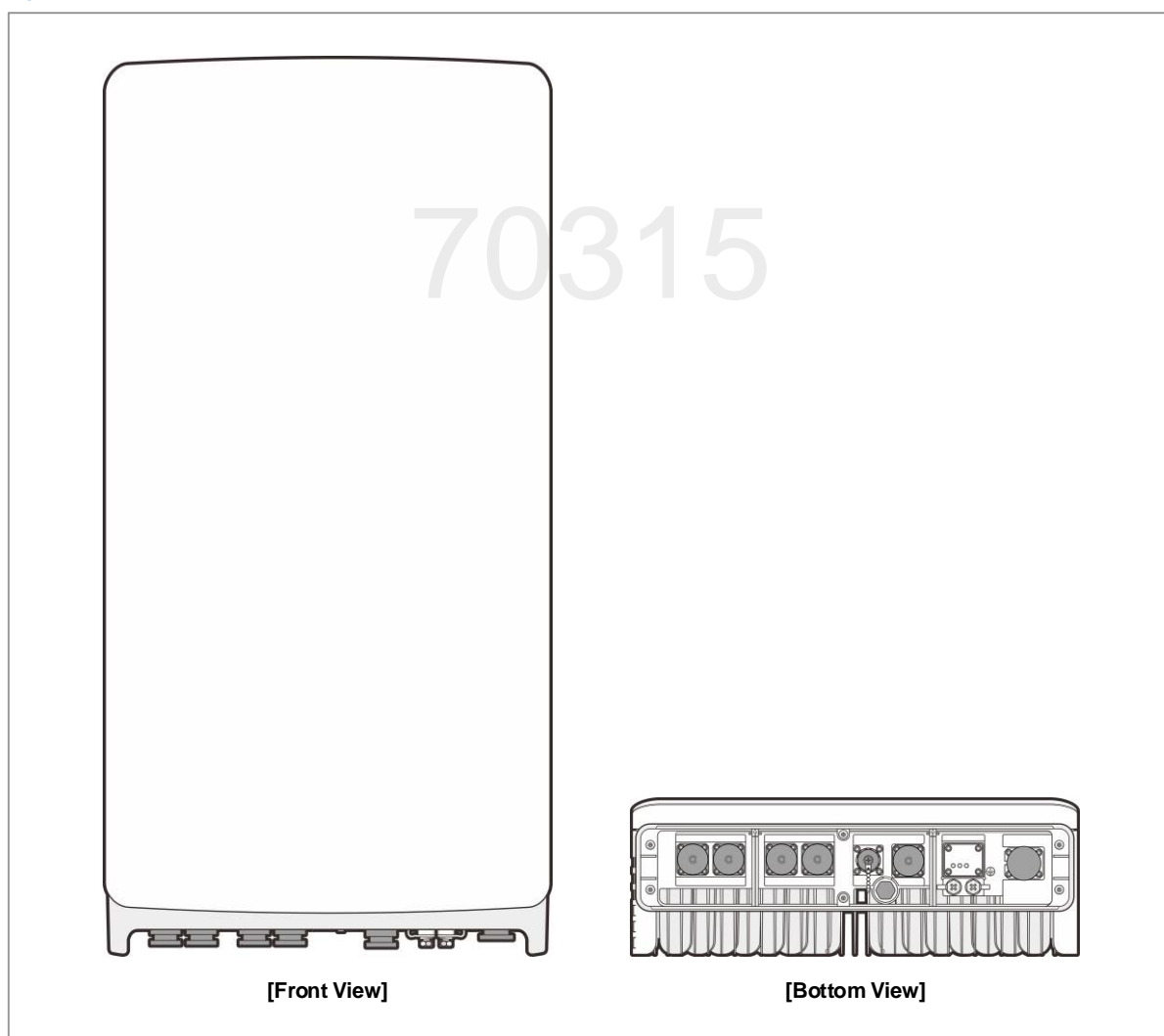
This chapter provides the hardware overview, functional description, and general specification of the product.

Overview

The MT6413-77A is a Massive MIMO Unit (MMU) consisting of digital and radio blocks. The digital block supports the interface with Digital Unit (DU) and the Low-PHY function (functional split option 7-2). The radio block transmits and receives the Radio Frequency (RF) signals with an integrated 64T64R antenna.

The following figure depicts the appearance of the MT6413-77A.

Figure 1. MT6413-77A Appearance



The following table outlines the name and description of the MT6413-77A.

Table 1. Name and Description of Units

Model Name	Description
MT6413-77A	3.7 GHz NR 64T64R 320 W MMU



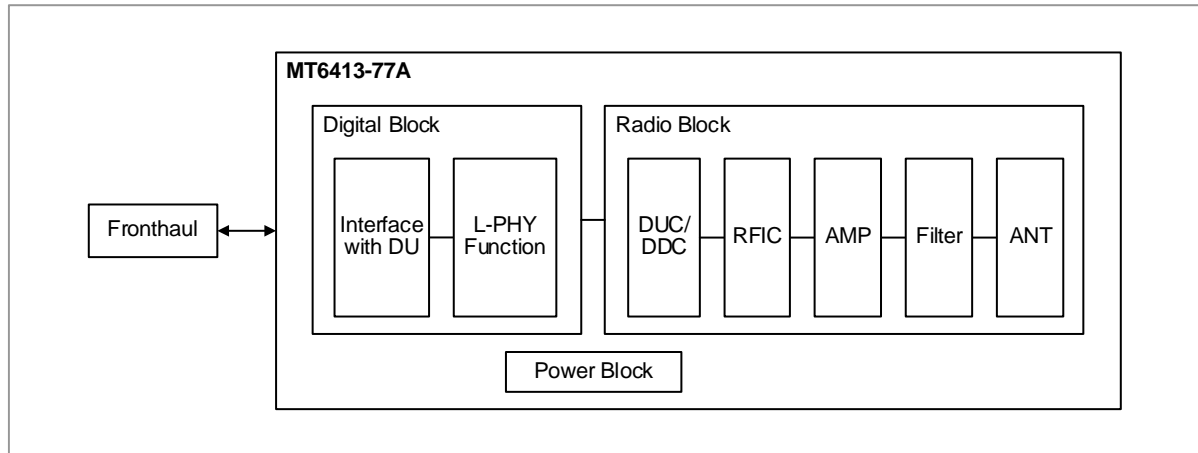
Some hardware configurations are not supported by all software releases or approved for all markets.

70315

Functional Description

The following figure depicts the block diagram of the MT6413-77A.

Figure 2. Block Diagram



The MT6413-77A consists of the digital block, the radio block, and the power block. The digital block consists of the interface block and the L-PHY block. The digital block supports the interface with the DU, operation, and management of the MT6413-77A and processes the L-PHY function, such as precoding, digital beamforming, iFFT/FFT, and so on.

The radio block consists of the digital up/down converter, RFIC (digital/analog converter), amplifier, filter, and 64T64R antenna.

Clock

The MT6413-77A supports CPRI clock recovery and IEEE1588v2/SyncE synchronization.

The MT6413-77A receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the MT6413-77A generates and distributes the clock for internal devices.

Cooling

The MT6413-77A uses a natural convection cooling method without using a fan.

Specifications

The following table displays the main specifications of the MT6413-77A.

Table 2. Specifications of the MT6413-77A

Item		MT6413-77A
Air Technology		5G
Band/Duplex		n77/TDD
OFR		3,700 to 3,980 MHz
IBW		200 MHz
OBW		200 MHz
Carrier Configuration	Ch. BW	NR 20/40/60/80/100 MHz
	Number of carriers (per unit)	2CC
TRX Path Configuration		64T64R
Antenna Configuration		4V16H 192 AE (3 x 1 sub-array)
Conductive Power		320 W
MIMO Capacity		DL 16L, UL 16RX (8L)
Function Split		Opt. 7-2x
Optic Interface		20 km, 25 Gbps x 4 ports
Input Voltage		-48 V DC (-36 to -58 V DC)
Power Consumption ^{a)}		<ul style="list-style-type: none"> • 882 W @ 40 % room temp • 1,260 W @ 100 % room temp • 1,299 W @ 100 % all temp
Volume / Dimension (W x H x D)		41.1 L / 15.75 x 28.9 x 5.51 in. (400 x 734 x 140 mm)
Weight		57.32 lb (26 kg) or less (without a Bracket)
Operating Temperature ^{b)}		-104 °F to +131 °F (-40 °C to +55 °C), (without solar load)
Cooling Scheme		Natural Convection
Installation		Pole, Wall
Operating Humidity ^{b)}		5% to 100% RH (non-condensing, not to exceed 30 g/m ³ absolute humidity)
Altitude		Telcordia GR-63-CORE, Issue 5, Section 4.1.3
Noise		Telcordia GR-487-CORE, Issue 5, Section 3.34 (45 dBA)
Ingress Protection Rating		IEC 60529 (IP65)
Salt Fog / Salt Spray		Telcordia GR-487-CORE, Issue 5, Section 3.40.1
Wind Resistance		Telcordia GR-487-CORE, Issue 5, Section 3.36
Earthquake		Telcordia GR-63-CORE, Issue 5, Section 4.4.1 (Zone 4)
Vibration		Telcordia GR-63-CORE, Issue 5, Section 4.4.4 / 4.4.5
EMC		FCC Title 47 CFR Part 15 Subpart B

Item	MT6413-77A
Safety	UL 62368-1
RF	FCC Title 47, CFR Part 27



1) These values are predictive of simulation. When development is completed, measurement data can change by +/- 10%.



2) Temperature and humidity are measured 1.5 m above the floor and 400 mm from the equipment's front panel.

70315

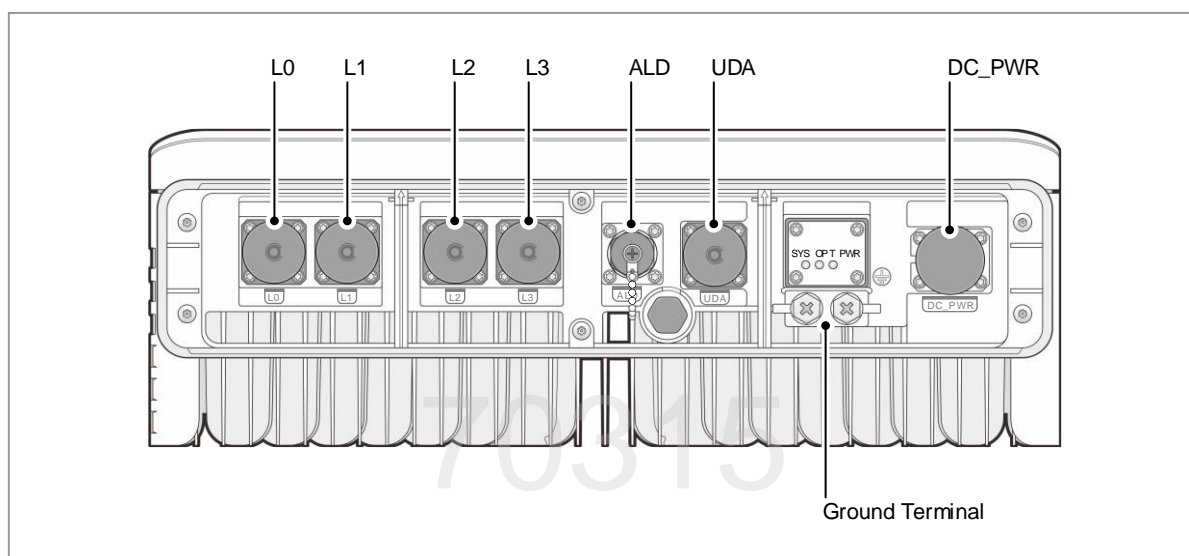
Chapter 2 External Interface

This chapter describes the external interfaces of the radio unit in detail.

Port Information

The following figure depicts the port information of the MT6413-77A.

Figure 3. MT6413-77A Port Information



The following table outlines the port information of the MT6413-77A.

Table 3. MT6413-77A Port Information

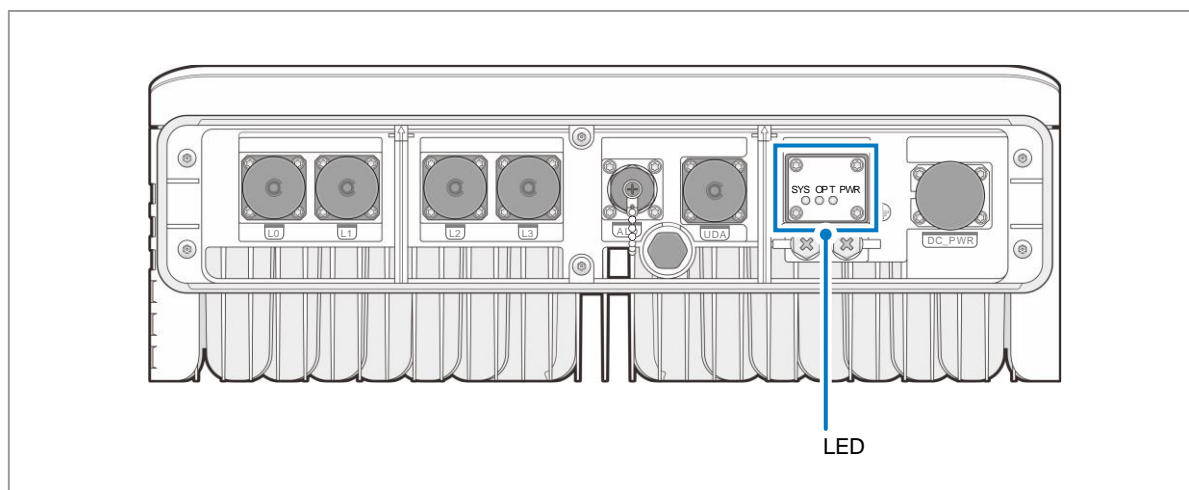
Port Name	Connector Type	Description
L0, L1, L2, L3	Push pull, SFP28 type	25GbE fronthaul optic interface
UDA	Push pull, RJ45 type	User-defined alarm (4 Rx)
DC_PWR	Push pull	-48 VDC (-36 to -58 VDC)
SYS, OPT, PWR	LED	Status LED for system, optic, power

LED Operation

The MT6413-77A displays the device status through the LED.

The following figure depicts the LED position of the MT6413-77A.

Figure 4. MT6413-77A LED Information



The following table describes the meaning of different LED states.

Table 4. SYS LED






Status	Description	
	Solid Red	<ul style="list-style-type: none"> Abnormal condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The CPRI link is not set up. The RU initialization is in progress (all paths are disabled).
	Blinking Red	<ul style="list-style-type: none"> Imperfect condition due to alarm At least one path has been shut down by a major alarm or disabled alarm, and at least one path functions properly.
	Solid Green	<ul style="list-style-type: none"> Standby condition No path has been shut down by a major alarm or disabled alarm, and all paths are operating abnormally. The RU initialization is complete and ready to send the notification message to the DU.
	Blinking Green	<ul style="list-style-type: none"> Normal condition No path has been shut down by a major alarm or disabled alarm, and at least one path functions properly. At least one carrier in the path functions properly in a multi-carrier case.
	Off	No DC input power

Table 5. OPT LED











Status		Description
	Solid Red	Optic RX LOS or optic Tx fault at all ports
	Blinking Red	Optic RX LOS or optic Tx fault at one of the port
	Solid Green	No optical module insert
	Blinking Green	No alarm, normal condition
	LED OFF	No DC input power

Table 6. PWR LED

Status		Description
	Solid Red	Shut down by Voltage High/Low major alarm.
	Blinking Red	Reserved.
	Solid Green	Reserved.
	Blinking Green	No alarm, normal condition
	OFF	No DC input power



70315

Appendix Acronyms

ADC	Analog to Digital Converter
AMP	Amplifier
ANT	Antenna
CPRI	Common Public Radio Interface
DDC	Digital Down Converter
DU	Digital Unit
DUC	Digital Up Converter
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
gNB	next generation Node B
LED	Light Emitting Diode
L-PHY	Low Physical Layer
MMU	Massive MIMO Unit
NR	New Radio
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
RU	Radio Unit
SFP	Small Form Factor Pluggable
UDA	User Defined Alarm

70315

102 MMU
Product Specification for MT6413-77A

Document Version 1.0

© 2023 Samsung Electronics Co., Ltd.
All rights reserved.

102 RRU Product Specification

for RF4439d-25A

Describes the product components, physical nature, specific functions, specifications, ports and LED information along with their characteristics as a reference for installation and O&M activities.

Document Version 1.0
July 2021

© 2021 SAMSUNG Electronics Co., Ltd.

All Rights Reserved. The contents of this document/presentation contain proprietary information that must be kept confidential. No part of this document shall be photocopied, reproduced, stored in a retrieval system, or transmitted, in any form or by any means whether, electronic, mechanical, or otherwise without the prior written permission of SAMSUNG Electronics Co., Ltd.

No warranty of accuracy is given concerning the contents of the information contained in this publication. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by SAMSUNG Electronics Co., Ltd., its subsidiaries or employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document. SAMSUNG Electronics Co., Ltd. reserves the right to change details in this publication without notice.

This manual should be read and used as a guideline for properly installing and/or operating the product.

This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Updated manuals are available at:

<https://systems.samsungwireless.com/>

For questions on the manuals or their content, contact

[NetSys Tech Writer@sea.samsung.com](mailto:NetSys_Tech_Writer@sea.samsung.com)

Contents

Preface		vi
	Relevance	vi
	Conventions in this Document	vi
	Revision History.....	vii
	Organization of This Document	vii
	Related Documentation	vii
	Personal and Product Safety	viii
	Equipment Markings	xii
Chapter 1	Introduction	1
Chapter 2	Overview	2
	Functional Description	4
	Hardware Block Diagram.....	4
	Clock	5
	Cooling	6
	<i>AISG 3.0</i>	6
	Specifications	7
Chapter 3	External Interface	9
	<i>LED Information</i>	10
	<i>Port Information</i>	11
Appendix	Acronyms	12

List of Figures

Figure 1.	Appearance	3
Figure 2.	4Tx/4Rx RRU Block Diagram.....	5
Figure 3.	AISG Interface	6
Figure 4.	External Interface	9

List of Tables

Table 1.	Name and Description of Units	2
Table 2.	Specifications (RF4439d-25A)	7
Table 3.	RF4439d-25A SYS LED Information	10
Table 4.	RF4439d-25A OPT LED Information	10
Table 5.	RF4439d-25A ANT LED Information	10
Table 6.	RF4439d-25A RET LED Information	11
Table 7.	RF4439d-25A Port Information	11

Preface

The Samsung eNB consists of Digital Unit (DU) and Remote Radio Unit (RRU). This manual describes the product components and is used as the reference for installation and O&M. It specifies the hardware configuration, functions, specifications, physical ports, and LED information of the RRU hardware.



Few hardware configurations are not supported by all the software releases or approved for all the markets.

Relevance







This manual applies to the following products/software.

Name	Type
RF4439d-25A PCS/AWS FDD 4Tx/4Rx RRU	Hardware

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`
- The command and counter are presented in Courier New font and bold style. For example, **RTRV-NE-STs**, **eutran-cell-conf-idle** or **CSL**.
- The alarm is presented in bold style. For example, **A2100216R ump temperature-high**.

Revision History

The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	July 2021	First version

Organization of This Document

Section	Title	Description
Chapter 1	Introduction	This chapter provides the introduction.
Chapter 2	Overview	This chapter provides the hardware overview, functional description, and general specifications.
Chapter 3	External Interface	This chapter describes the LED information, and the port information of the Radio Unit.
Appendix	Acronyms	This appendix spells out the acronyms used in this manual.

Related Documentation

- 201 LTE eNB Dimensioning and Configuration Manual
- 101 LTE eNB System Description
- 310 LTE RU (RRU) Installation Manual

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by IEC/EN/UL/CSA 62368 or 60950. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under EN 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

To protect against potential fire due to current overload, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product is natural convection cooling type.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with IEC/EN/UL/CSA 62368 or 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of IEC/EN/UL/CSA 62368 or 60950 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery.

End of life recycling materials information is available from Samsung.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California USA.

‘Perchlorate Material-special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.’

Equipment Markings



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.



Hot surface warning

Allow to cool before servicing.

Do not touch before cooling.

Notice! Be careful not to touch due to high temperature.

The system must be installed in a restricted area, and make sure the work is done by personnel properly trained for the job.



Protective earth

RRU should be grounded.

Chapter 1 Introduction

The Samsung eNB consists of the Digital Unit (DU) and the Radio Unit (RU). The DU is a digital unit and can be mounted in to an indoor or outdoor 19-inch commercial rack. The RU is a RF integration module consisting of a transceiver, power amplifier, and filter. It transmits and receives traffic, clock information, and alarm and control messages to and from the DU.

This document describes the product components, serving as the reference for installation and O&M. It specifies hardware configuration, functions, specifications, component ports, and LED information of the RU hardware component.

The document is divided into three chapters. An overview of all the chapters is given in this section.

- Introduction
This chapter provides an introduction of the document.
- Overview
This chapter describes the hardware overview, functional description, and general, mechanical and environmental specification for the RU products.
- Radio Units
This chapter describes hardware components of radio unit in detail, such as appearance of external interface, and detail information of ports and LED.
- Acronyms
This appendix spells out the acronyms used in this document.

Chapter 2 Overview

The Remote Radio Unit (RRU) consists of the RF chains of 4Tx/4Rx which is an integrated RF unit that includes a transceiver, a power amplifier, and a filter in an enclosure.

The following table outlines the name and description of the RRU (RU).

Table 1. Name and Description of Units

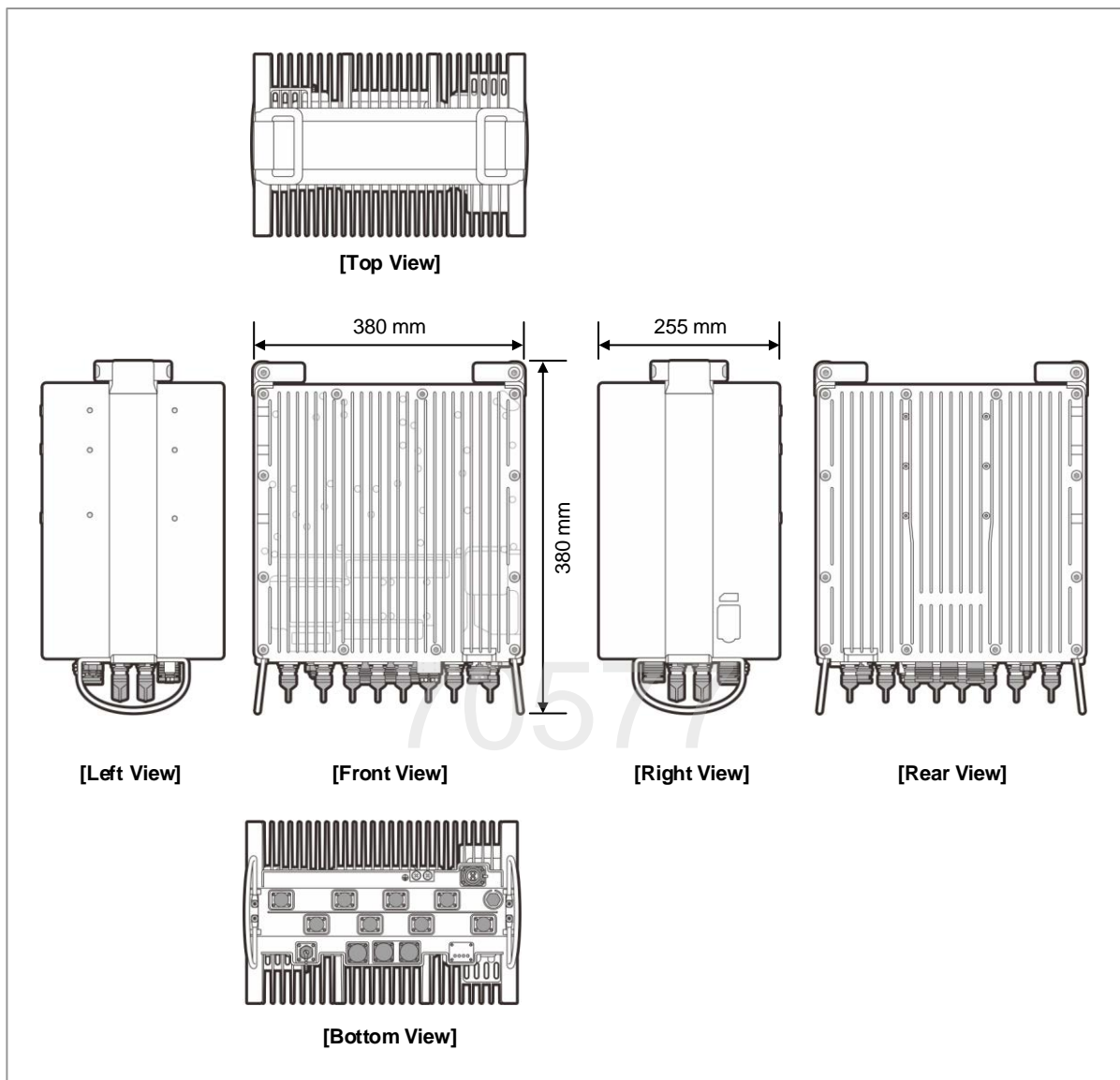
Model Name	Description
RF4439d-25A	PCS/AWS FDD 4Tx/4Rx RRU (RU)



Few hardware configurations are not supported by all the software releases or approved for all the markets.

The following figure depicts the physical view of the RRU (RF4439d-25A):

Figure 1. Appearance



Functional Description

In downlink path, the RRU performs Optical-to-Electrical (O/E) conversion for baseband signals received from the DU via the optic CPRI (SVR21C) or optic eCPRI (SVR21D). Then, the electrical digital signals are converted into analog signals by the DAC. The frequency of these analog signals is converted upward through the modulator and these signals are amplified into high-power RF signals through the power amplifier. The amplified signals are transmitted to antenna through the filter.

In uplink path, the RF signals received through filter of the RRU are low-noise amplified by the Low Noise Amplifier (LNA) and their frequency is down-converted through the demodulator. These down-converted frequency signals are converted into baseband signals through the ADC. The signals converted into baseband are changed to Electrical-to-Optical (E/O) and transmitted to the DU through the CPRI.

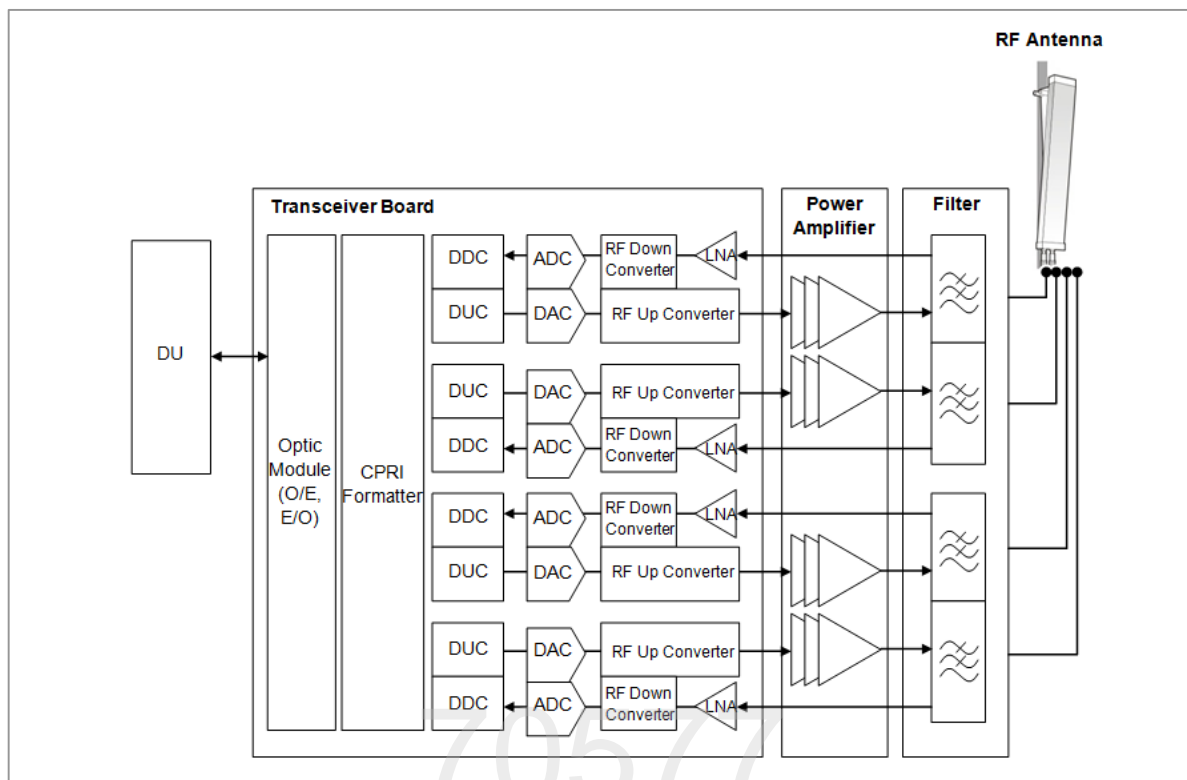
The DU transmits control signals to the RRU via the control path (channel) of the CPRI.

Hardware Block Diagram

The description for the block diagram is given in the above section.

The following figure is the block diagrams of 4Tx/4Rx RRU:

Figure 2. 4Tx/4Rx RRU Block Diagram



Clock

The RRU supports the CPRI clock recovery (SVR21C) and IEEE1588v2/SyncE synchronization (SVR21D).

The RRU receives the synchronization signal from the CPRI and IEEE1588v2/SyncE. After receiving the signal, the RRU generates and distributes the clock for internal devices.

Cooling

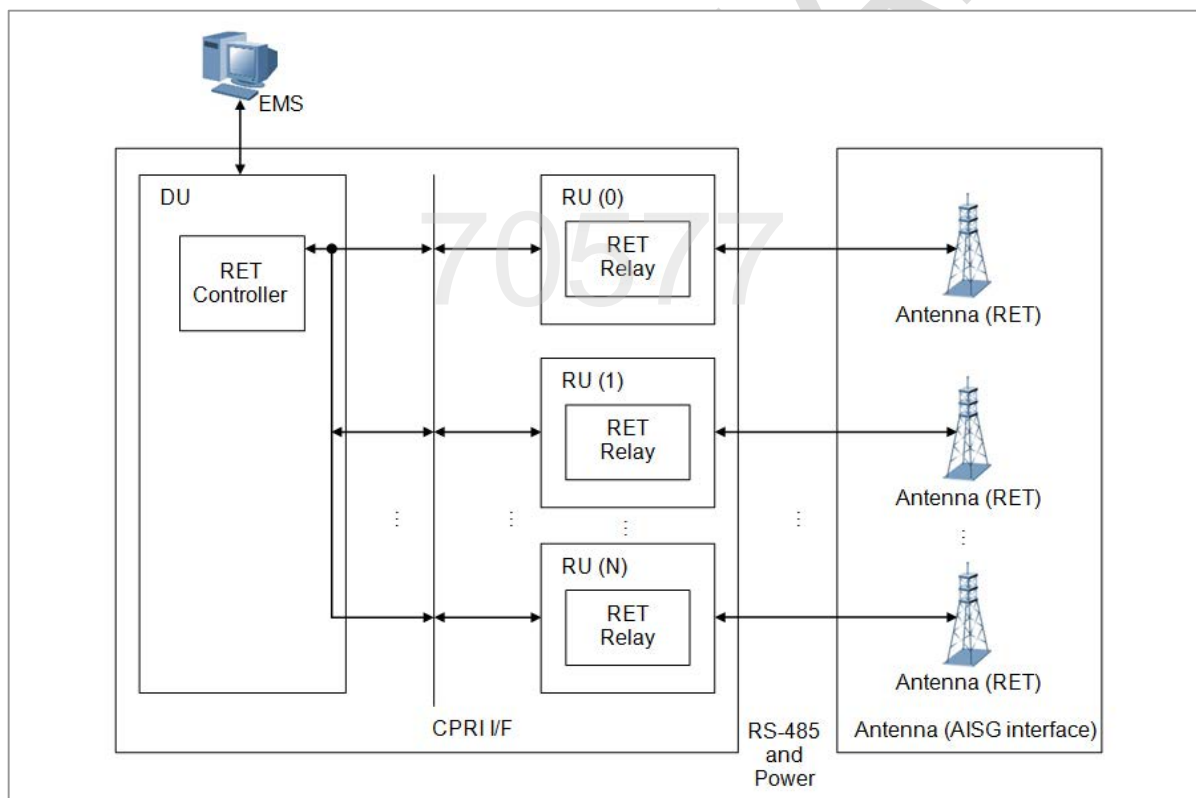
The RRU is designed to discharge the heat effectively through natural cooling without additional cooling devices.

AISG 3.0

The Samsung eNB can provide Remote Electrical Tilt (RET) function by connecting the AISG 3.0 interface-compatible antenna to the RRU.

For the RET function, the Samsung eNB transmits and receives control messages to and from the EMS via the RET controller in the Main Card. The EMS can remotely control the tilting angle of the antenna. In addition, the RRU provides power to the RET device of the antenna for the RET operation. Refer to the following block diagram:

Figure 3. AISG Interface



Specifications

The following table outlines the main specifications of RF4439d-25A.

Table 2. Specifications (RF4439d-25A)

Category		Description
Air Standard		LTE and 5G NR
Duplex Type		FDD
Antenna Port Configuration		For AWS/PCS band respectively, 4T4R: T/R T/R T/R T/R 2T4R: T/R T/R R R 2T2R: T/R T/R 2T2R + 2T2R 2sector
Operating Frequency	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,930 - 1,995 MHz B66(B4)/n66(n4): 2,110 - 2,200 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 1,850 - 1,915 MHz B66(B4)/n66(n4): 1,710 - 1,780 MHz
Channel Bandwidth ^{a)}		5/10/15/20 MHz (LTE/NR)
IBW	TX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4): 90 MHz
	RX	<ul style="list-style-type: none"> B25(B2)/n25(n2): 65 MHz B66(B4)/n66(n4) : 70 MHz
Max number of Carriers		5/10/15/20 MHz 4T4R case: Total Max. 7CC within (PCS: 3CC, AWS: 5CC)
OBW		<ul style="list-style-type: none"> B25(B2)/n25(n2): 30MHz B66(B4)/n66(n4): 60MHz
Output Power		Max. 320 W within, <ul style="list-style-type: none"> B25(B2)/n25(n2): 40 W x 4 path or 60 W x 2 path B66(B4)/n66(n4): 60 W x 4 path or 80 W x 2 path
Fronthaul Interface		Optical (e)CPRI 2 port (10 Gbps x 2 port)
Function Split		DL/UL Option 8 (SVR21C) DL/UL Option 7-2x Cat.A (SVR21D)
Dimension (W x H x D)		380 x 380 x 255 mm (14.96 x 14.96 x 10.04 inch) Excluding connector, partial extrusion, flange
Weight (kg)		Under 33.9 (excluding bracket) 74.74 lbs
Cooling		Natural convection cooling
Input Voltage		-48 V DC (-38 V to -57 VDC)
Power consumption		<ul style="list-style-type: none"> Typical (W)-Load 100 % 1270 W @ room temp Maximum (W)-Load 100 % 1459 W @ all temp
Operating Temperature		<ul style="list-style-type: none"> -40 °C to 55 °C (without solar load) -40°C to 50°C (with solar load)
Operating Humidity		5% to 100%RH (Condensing, not to exceed 30g/m3 absolute humidity)
Installation		Pole, wall, tower, side-by-side, back to back

Category	Description
Vibration	Telcordia GR-63-CORE, Issue5, <ul style="list-style-type: none">• Office Vibration (Section 4.4.4)• Transportation Vibration (Section 4.4.5)
Ingress Protection Rating	IP65 (IEC 60529)
RF	FCC Title 47 CFR Part 27, 24
Safety	UL 62368-1



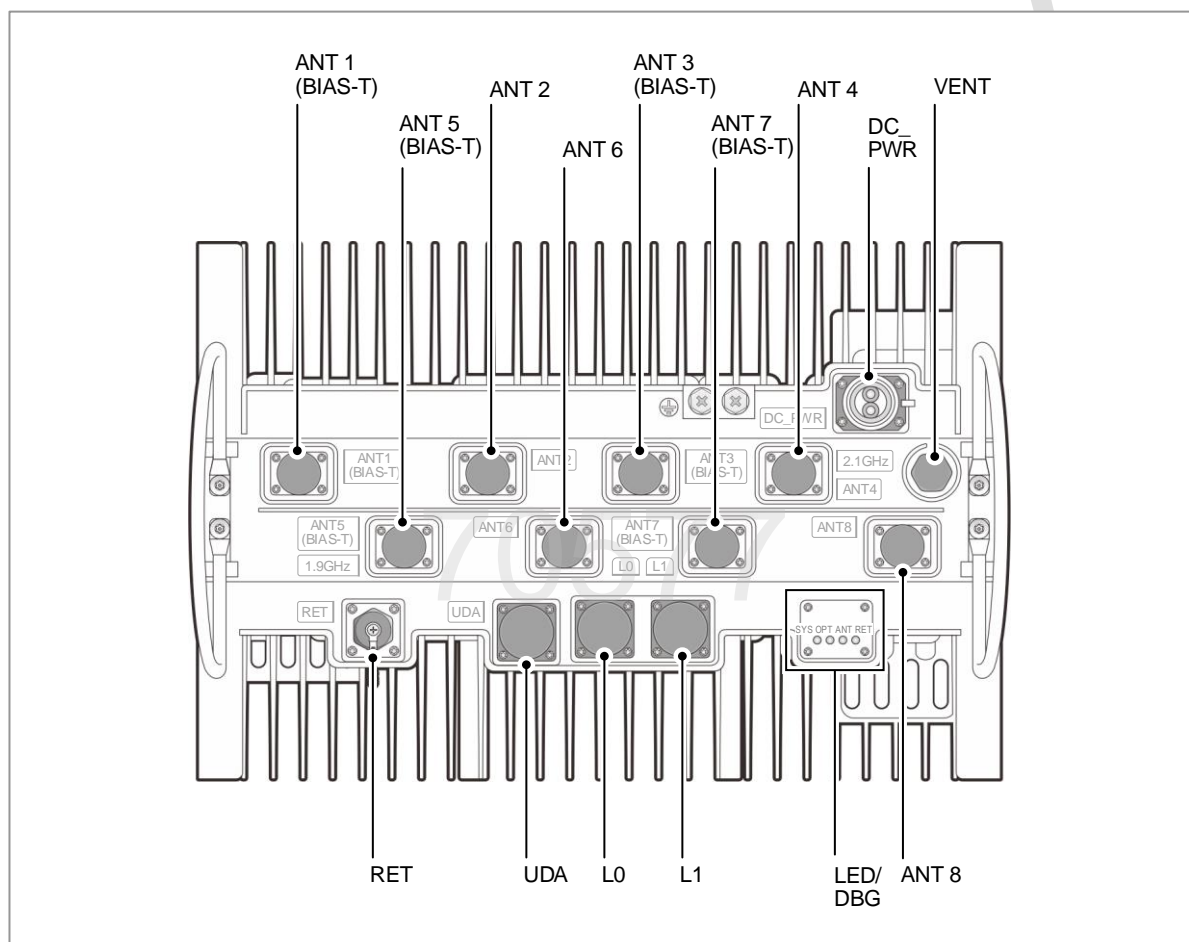
The power consumption is predicted with a simulation and the measured value is subject to change by $\pm 10\%$.

Chapter 3 External Interface

This chapter describes the LED information, and the port information of the RF4439d-25A.

The following figure depicts the external interface of the RF4439d-25A.

Figure 4. External Interface



LED Information

The LED displays the current status of RF4439d-25A as described in the following tables.

Table 3. RF4439d-25A SYS LED Information






Status	Description	
	Green Blinking	<ul style="list-style-type: none"> Normal condition No path has shut down by major alarm or disable alarm and at least one path works in normal operation. In multi-carrier case, at least one carrier in path works in normal operation.
	Green ON	<ul style="list-style-type: none"> Standby condition No path has shut down by major alarm or disable alarm and no path works in normal operation. The RRU initialization is completed and ready to send the notification message to the DU.
	Red Blinking	<ul style="list-style-type: none"> Imperfect condition due to the alarm At least one path has shut down by major alarm or disabled alarm and at least one path works in normal operation
	Red ON	<ul style="list-style-type: none"> Abnormal condition due to the alarm At least one path has shut down by the major alarm or disabled alarm (Except for Voltage High/Low Major Alarm) and no path works in normal operation. The CPRI link is not set up. The RRU Initialization is in progress. (All paths are disabled.)
	OFF	Shut down by Voltage High/Low Major Alarm

Table 4. RF4439d-25A OPT LED Information






Status	Description	
	Green Blinking	No Alarm, Normal condition
	Green ON	No optical module insert
	Red Blinking	Optic RX LOS or Optic Tx fault at one of the port
	Red ON	Optic RX LOS or Optic Tx fault at all the ports
	OFF	RRU input power off (No DC or AC input power)

Table 5. RF4439d-25A ANT LED Information












Status	Description	
	Green Blinking	No VSWR Alarm, Normal condition
	Green ON	No RF output power (PA disable)
	Red Blinking	VSWR Alarm occurs at one of the paths.
	Red ON	VSWR Major Alarm (All paths)
	OFF	RRU input power off (No DC or AC input power)

Table 6. RF4439d-25A RET LED Information

Status	Description	
	Green Blinking	When the RRU receives data by the RET.
	Green ON	<ul style="list-style-type: none"> RET power is OK. There is no RET data received for 180 s.  If RET is disconnected, the blinking green status can last for 180 s.
	Red Blinking	Reserved.
	Red ON	RET power fails.
	OFF	RRU input power off (No DC or AC input power).

Port Information

The following table outlines the port information of the RF4439d-25A.

Table 7. RF4439d-25A Port Information

Port Name	Connector Type	Description
RET	8-pin Circular	AISG interface
L0, L1,	Push pull, SFP+	CPRI optic connector used to connect to the DU 10Gbps fronthaul optic interface, 2 ports, 20 km <ul style="list-style-type: none"> Number marking: #0 - 1
DC_PWR	Push pull	-48 VDC (-38 to -57 VDC)
ANT_1 - 8	4.3-10 Plus female	TX/RX RF Antenna
UDA	Push pull, RJ45 type	User defined alarm (4 Rx)
LED	-	SYS, OPT, ANT, RET

Appendix Acronyms

ADC	Analog to Digital Converter
AISG	Antenna Interface Standard Group
CPRI	Common Public Radio Interface
DAC	Digital to Analog Converter
DU	Digital Unit
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
FITF	Field Installation Test Function
FPGA	Field Programmable Gate Array
LNA	Low Noise Amplifier
LSM	LTE System Manager
MMU	Massive MIMO Unit
RET	Remote Electrical Tilting
RF	Radio Frequency
RRU	Remote Radio Unit
RU	Radio Unit
SFP	Small Form Factor Pluggable
SMA	Sub Miniature Version A
UDA	User Defined Alarm

PRELIMINARY

102 RRU

Product Specification for RF4439d-25A

Document Version 1.0

© 2021 Samsung Electronics Co., Ltd.
All rights reserved.



MX06FHG865-HG

NWAV™ X-Pol Hex-Port Antenna

X-Pol Hex-Port 8 ft 65° Form in Tighter High Gain (FHG) with Smart Bias Ts, 698-2180 MHz:

2 ports 698-894 MHz and 4 ports 1695-2200 MHz

- Industry-leading high gain for MB and LB for extended cell coverage
- Excellent passive intermodulation (PIM) performance reduces harmful interference.
- Fully integrated (iRETs) with independent RET control for low and high bands for ease of network optimization
- Suitable for LTE/CDMA/PCS/UMTS/GSM air interface technologies
- Integrated Smart Bias-Ts reduce leasing costs
- Optimized width for reduced wind loading



NWAV™

Electrical specification (minimum/maximum)	Ports 1, 2		Ports 3, 4, 5, 6		
Frequency bands, MHz	698-806	806-894	1695-1880	1850-1990	1920-2200
Polarization	± 45°		± 45°		
Max gain over all tilts, dBi	17.2	17.6	19.4	19.5	20.0
Average gain, dBi	17.1 ± 0.1	17.3 ± 0.3	19.3 ± 0.1	19.2 ± 0.3	19.7 ± 0.3
Horizontal beamwidth (HBW), degrees	67.0	65.0	63.0	63.0	62.0
Front-to-back ratio, co-polar power @180°± 30°, dB	>25.0	>25.0	>28.0	>26.0	>25.0
X-Pol discrimination (CPR) at boresight, dB	>20.0	>18.0	>25	>20	>18
Sector power ratio, percent ¹	<4.0	<3.6	<5.0	<3.8	<3.6
Vertical beamwidth (VBW), degrees ¹	9.3	8.4	5.0	4.9	4.5
Electrical downtilt (EDT) range, degrees	0-10		0-7		
First upper side lobe (USLS) suppression, dB ¹	≤-16.0	≤-15.0	≤-16.0	≤-16.0	≤-16.0
Cross-polar isolation, port-to-port, dB ¹	25	25	25	25	25
Max VSWR / return loss, dB	1.5:1 / -14.0		1.5:1 / -14.0		
Max passive intermodulation (PIM), 2x20W carrier, dBc	-153		-153		
Max input power per any port, watts	300		250		
Total composite power all ports, watts	1500				

¹ Typical value over frequency and tilt

**MX06FHG865-HG****NWAV™ X-Pol Hex-Port Antenna****Mechanical specifications**

Dimensions height/width/depth, inches (mm)	95.9/ 12.2/ 7.5 (2436/ 310/ 191)
Shipping dimensions length/width/height, inches (mm)	106/ 20/ 15 (2692/ 508/ 381)
No. of RF input ports, connector type, and location	6 x 4.3-10 female, bottom
RF connector torque	96 lbf-in (10.85 N·m or 8 lbf-ft)
Net antenna weight, lb (kg)	51 (23.1)
Shipping weight, lb (kg)	100 (45.3)
Antenna mounting and downtilt kit included with antenna	91900318, 91900319 (middle bracket)
Net weight of the mounting and downtilt kit, lb (kg)	26 (11.82)
Range of mechanical up/down tilt	-2° to 12°
Rated wind survival speed, mph (km/h)	150 (241)
Frontal and lateral wind loading @ 150 km/h, lbf (N)	90.5 (402.6), 81.2 (361.2)
Equivalent flat plate @ 100 mph and Cd=2, sq ft	2.27
EPA frontal and lateral, ft², (m²)	4.1 (0.38), 2.2 (0.20)

Front view**Back view****Bottom view**12.2 in.
[310 mm]95.9 in.
[2436 mm]24.0 in. [610 mm]
bracket mounting
holes34.2 in. [869 mm]
bracket mounting
holes19.1 in.
[486 mm]**Ordering information**

Antenna model	Description
MX06FHG865-HG	8F X-Pol HEX FHG 65°, 0-10° / 0-7° RET, 4.3-10 & SBT
Optional accessories	
AISG cables	M/F cables for AISG connections
PCU-1000 RET controller	Stand-alone controller for RET control and configurations

Remote electrical tilt (RET 1000) information

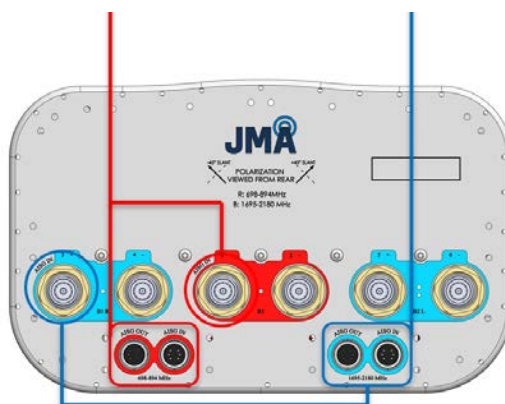
RET location	Integrated into antenna
RET interface connector type	8-pin AISG connector per IEC 60130-9
RET connector torque	Min 0.5 N·m to max 1.0 N·m (hand pressure & finger tight)
RET interface connector quantity	2 pairs of AISG male/female connectors
RET interface connector location	Bottom of the antenna
Total no. of internal RETs (low bands)	1
Total no. of internal RETs (high bands)	1
RET input operating voltage, vdc	10-30
RET max power consumption, idle state, W	≤ 2.0
RET max power consumption, normal operating conditions, W	≤ 13.0
RET communication protocol	AISG 2.0 / 3GPP

RET and RF connector topology

Each RET device can be controlled either via the designated external AISG connector or RF port as shown below:

RET device	Band	RF port
R1	698-894	1-2

RET device	Band	RF port
B1/B2	1695-2200	3-6



Array topology

3 sets of radiating arrays

R1: 698-894 MHz
B1: 1695-2200 MHz
B2: 1695-2200 MHz

Band	RF port
1695-2200	3-4
698-894	1-2
1695-2200	5-6



700/850 4T4R Macro 320W ORU - New Filter (RF4461d-13A)

SAMSUNG

Specifications



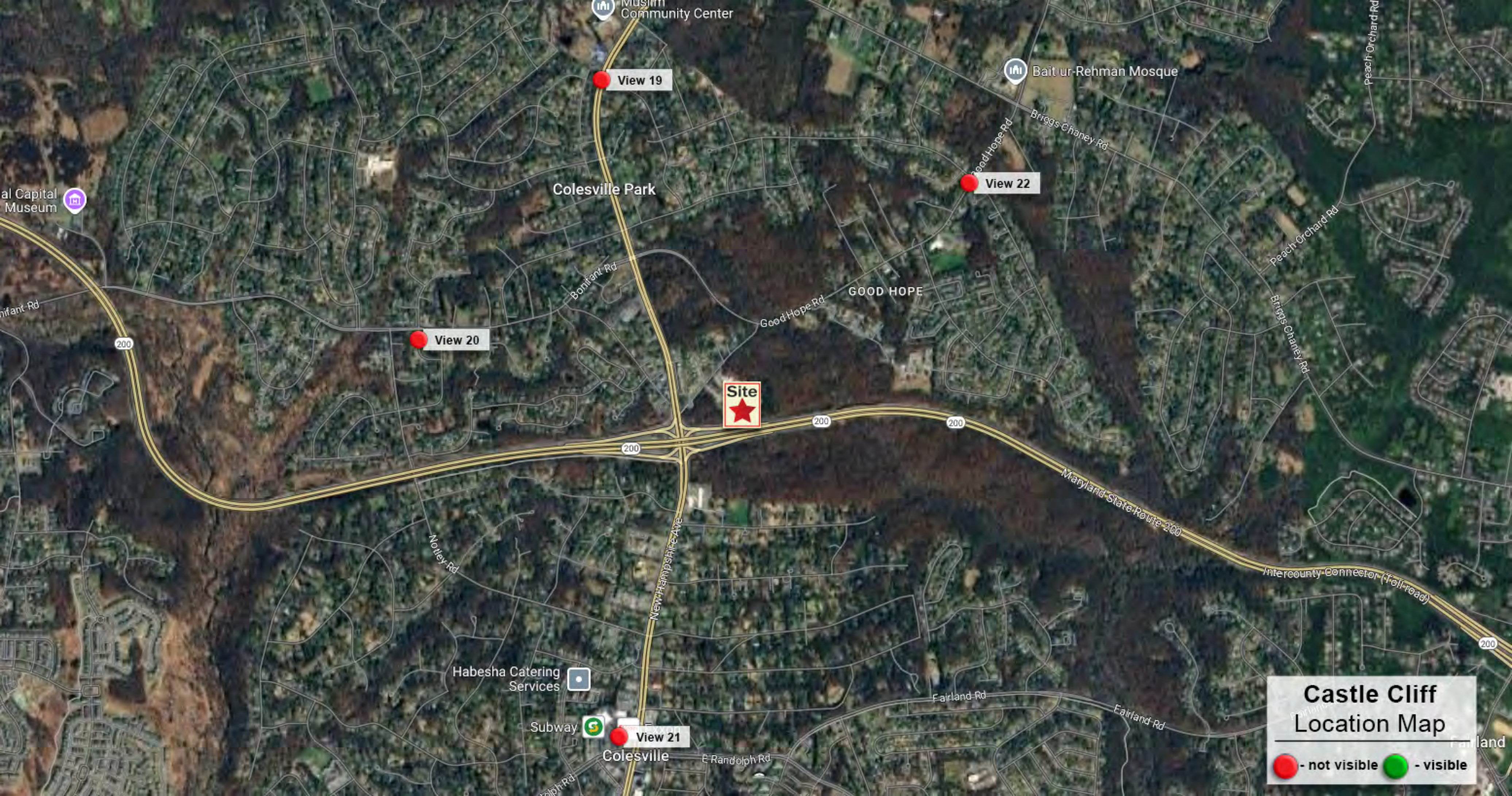
* 5MHz supporting in B13(700MHz) depends on 3GPP std. and UE capability.
External filters in interferer and victim sides for Mexican boarder to support 5MHz service need to be considered
** Finger guard is not needed.

Item	Specification	
Air Interface	LTE, NR(HW resource ready)	
Band	Band13 (700MHz)	Band5 (850MHz)
Frequency	DL: 746~756MHz	DL: 869~894MHz
	UL: 777~787MHz	UL: 824~849MHz
IBW	10MHz	25MHz
OBW	10MHz	25MHz
Carrier Bandwidth	LTE/NR 5*/10MHz	LTE 5/10MHz NR 5/10/15/20MHz
# of carriers	2C*	3C
Total # of carriers	4C + B13 (SDL) 1C	
RF Chain	4T4R/2T4R/2T2R/1T2R	
	2T2R+2T2R bi-sector	
RF Output Power	Total : 320W	
	4 x 40W or 2 x 60W	4 x 40W or 2 x 60W
Spectrum Analyzer	TX/RX Support	
RX Sensitivity	Typ. -104.5dBm @1Rx (25RBs 5MHz)	
Modulation	256QAM support, (1024QAM with 1~2dB power back-off)	
Input Power	-48VDC (-38VDC to -57VDC)	
Power Consumption	1,165 Watt @ 100% RF load, room temperature	
Size (WHD)	380 x 380 x 260 mm (14.96 x 14.96 x 10.23 inch)	
Volume	37.5 L	
Weight (W/o Solar Shield & finger guard)	35.9 kg (79.1 lb)	
Operating Temperature	-40°C (-40°F) ~ 55°C (131°F) (Without solar load)	
Cooling	Natural convection	
Unwanted Emission	3GPP 36.104	3GPP 36.104
	FCC 47 CFR 27.53 c), f)	FCC 47 CFR 22.917
	-	-69 dBm/100 kHz per path @ 896 ~901MHz
CPRI Cascade	Not supported	
Optic Interface	20km, 2 ports (9.8Gbps x 2), SFP+, single mode, Duplex (Option: Bi-di)	
RET & TMA Interface	AISG 3.0	
Bias-T	4 ports (2 ports per band)	
Mounting Options	Pole, wall	
NB-IoT	2GB+2IB or 4IB	2SA+2GB or 2GB+2IB or 4GB
PIM Cancellation	Support	
# of antenna port	4	
External Alarm	4	
Fronthaul Interface	Opt. 8 CPRI / Opt. 7-2x selectable (not simultaneous support)	
CPRI compression	Not Support	



**Castle Cliff
Location Map**

● - not visible ● - visible



View 19

View 22

View 20

View 21

Site

**Castle Cliff
Location Map**

 - not visible  - visible



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 1-MD Route 200
View from the South
Located .08 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 2-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
Showing the Proposed Site



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Existing Site



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 3-Drayton Avenue
View from the Northwest
Located .22 miles from Tower Site
Showing the Proposed Site



Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Existing Site



Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 4-Cape May Road-
Site Entrance
View from the West
Located .13 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Existing Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 5-Old Bonifant Road &
Amberleigh Drive
View from the Northwest
Located .29 miles from Tower Site
Showing the Proposed Site





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 6-MD Route 200
View from the Southeast
Located .10 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 7-New Hampshire Avenue
View from the Northwest
Located .25 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 8-Cape May Road
View from the Northwest
Located .14 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 9-Cape May Road
View from the West
Located .16 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 10-Bonifant Road &
New Hampshire Avenue
View from the Northwest
Located .52 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 11-Good Hope Road &
Cape May Road
View from the North
Located .24 miles from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 12-Good Hope Road
View from the Northeast
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 13-New Hampshire Avenue
View from the Northeast
Located .41 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 14-Amberleigh Drive
View from the West
Located .48 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 15-Amberleigh Drive
View from the West
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 16-Colesville Manor Drive
View from the Southwest
Located .43 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 17-Hobbs Drive
View from the Southwest
Located .37 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 18-Hobbs Drive
View from the South
Located .34 miles from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:
View 19-New Hampshire Avenue &
Southview Avenue
View from the Northwest
Located 1 mile from Tower Site
SITE NOT VISIBLE



Site Name: Castle Cliff

Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

Photograph Information:

View 20-Sandy Ridge Road
View from the West
Located .93 miles from Tower Site
SITE NOT VISIBLE





Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

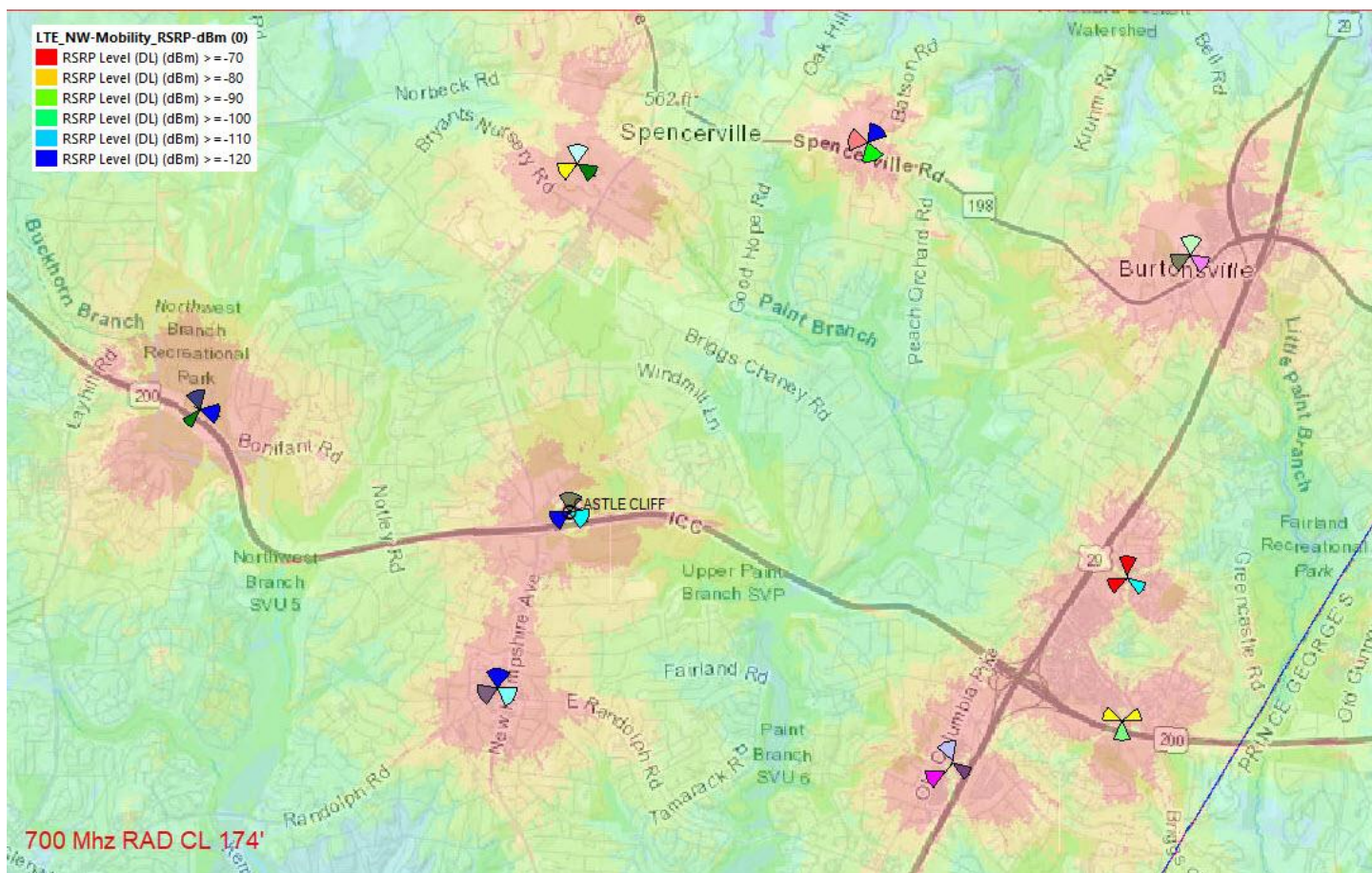
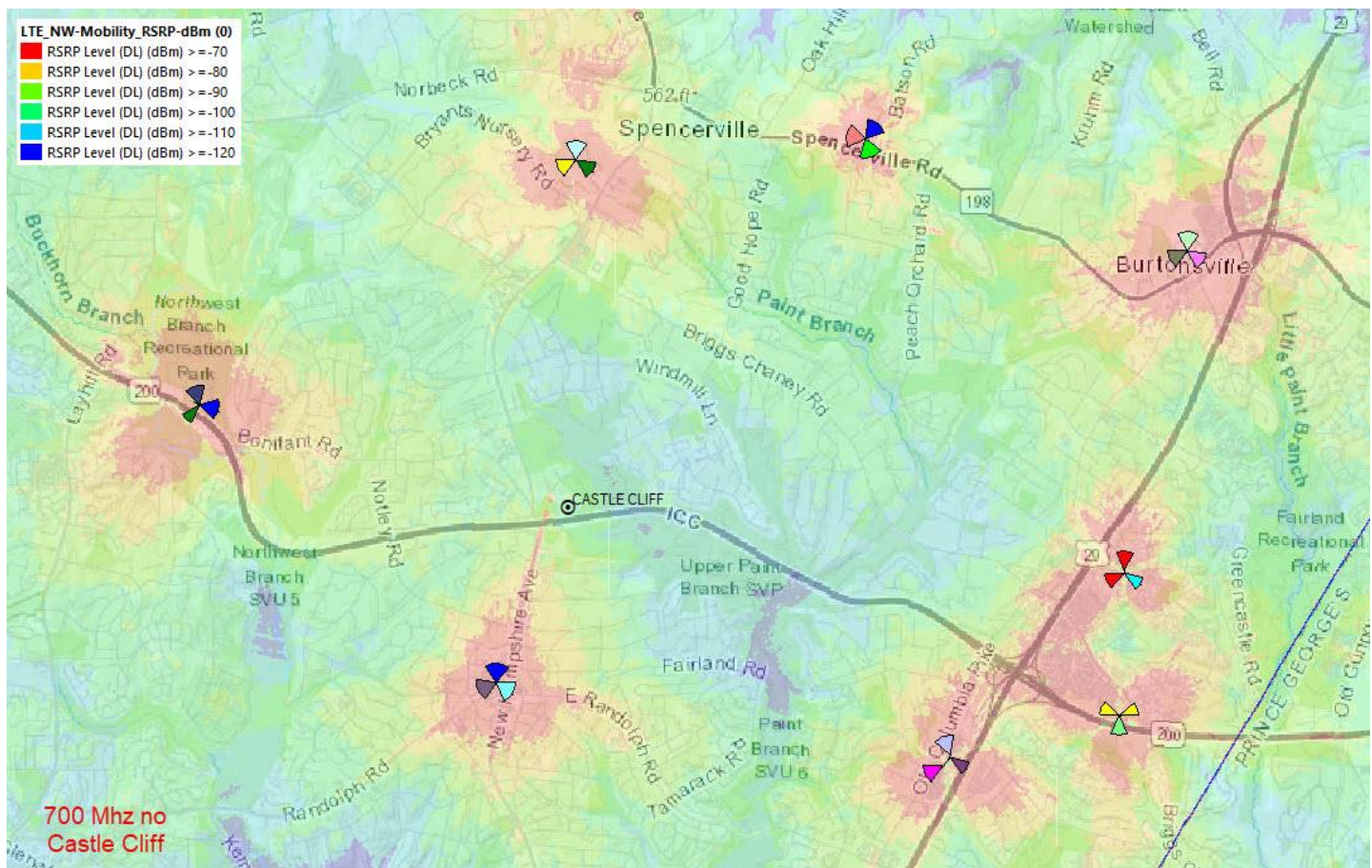
Photograph Information:
View 21-Colesville Shopping Center
View from the Southwest
Located 1 mile from Tower Site
SITE NOT VISIBLE

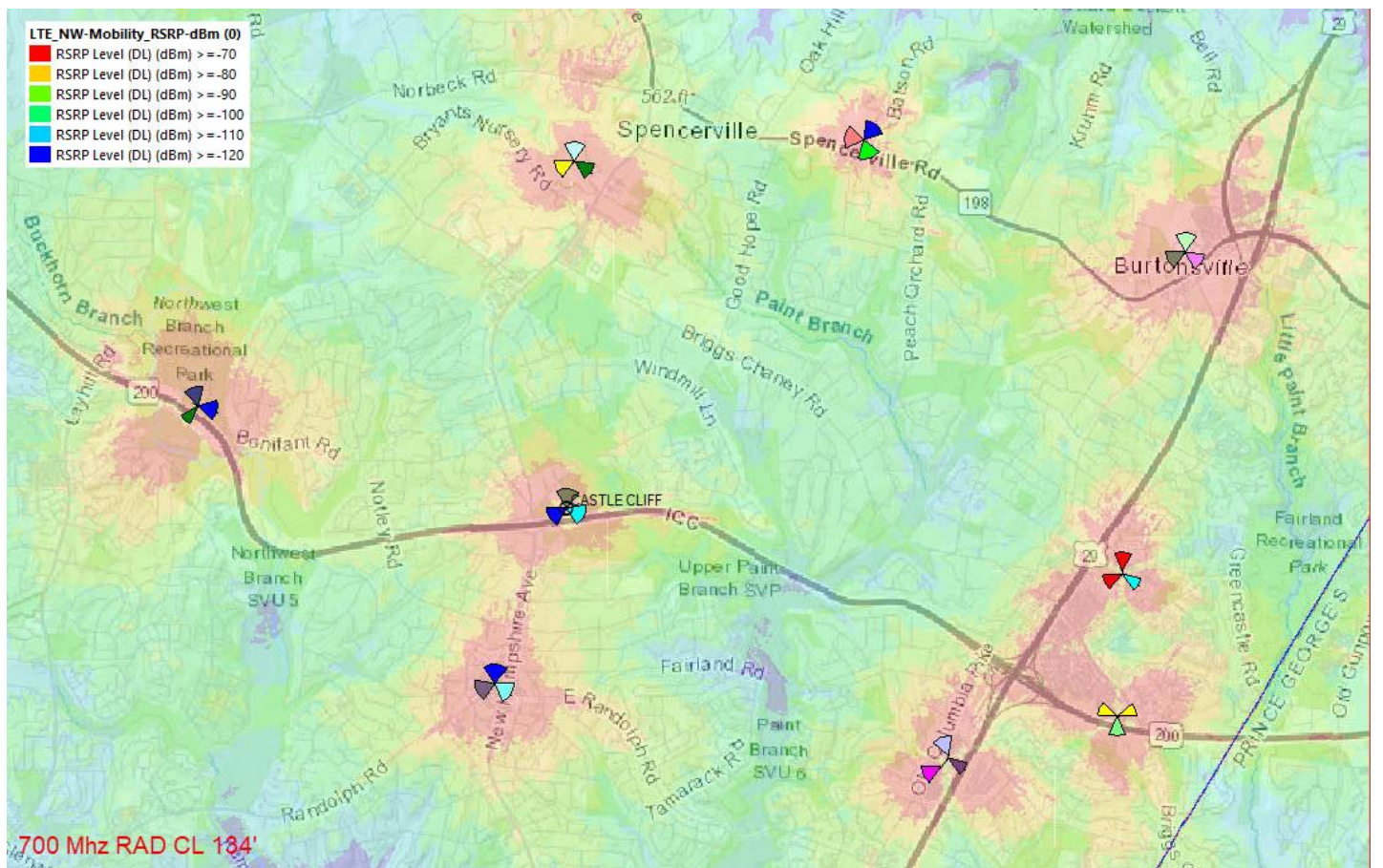
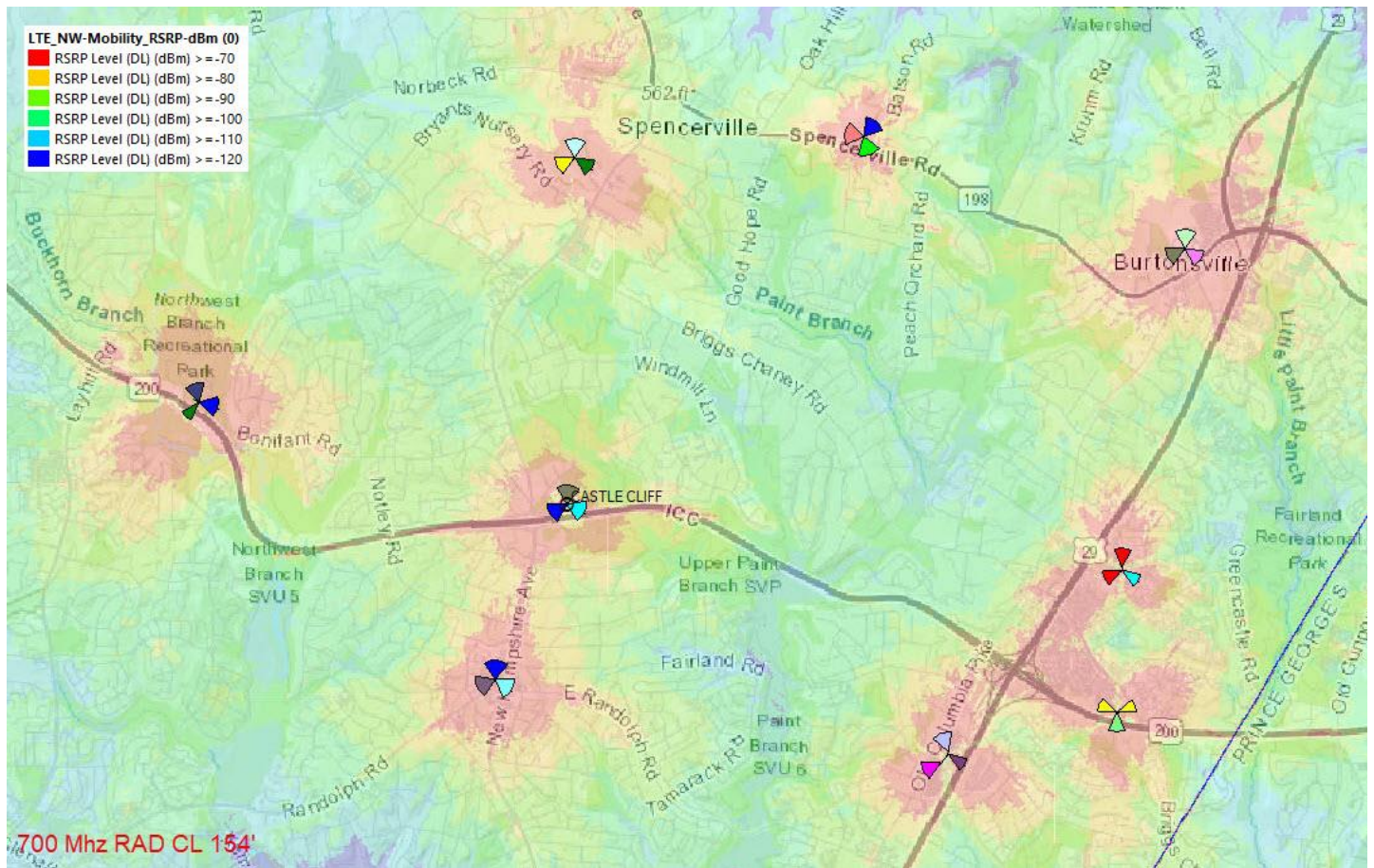


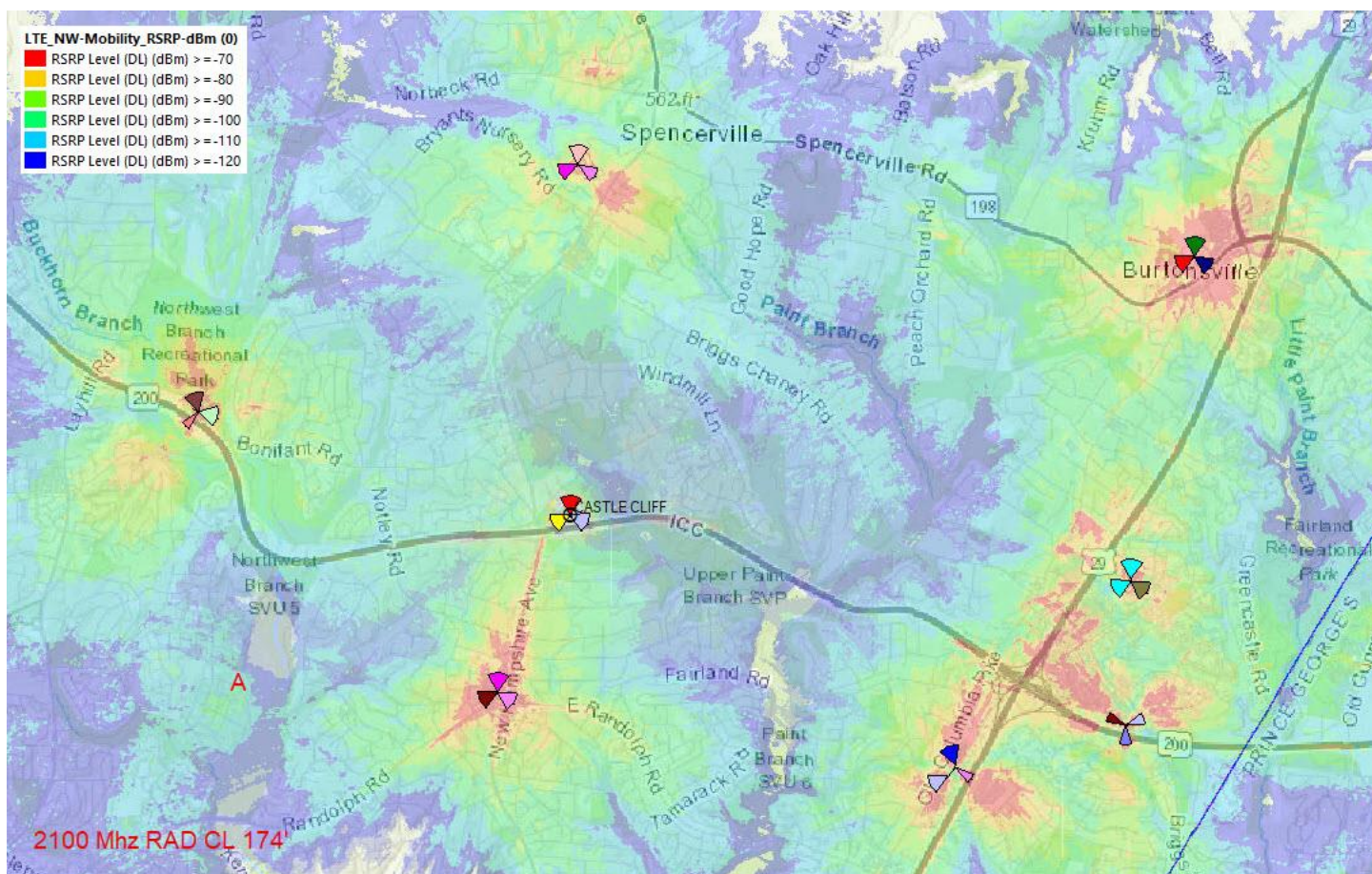
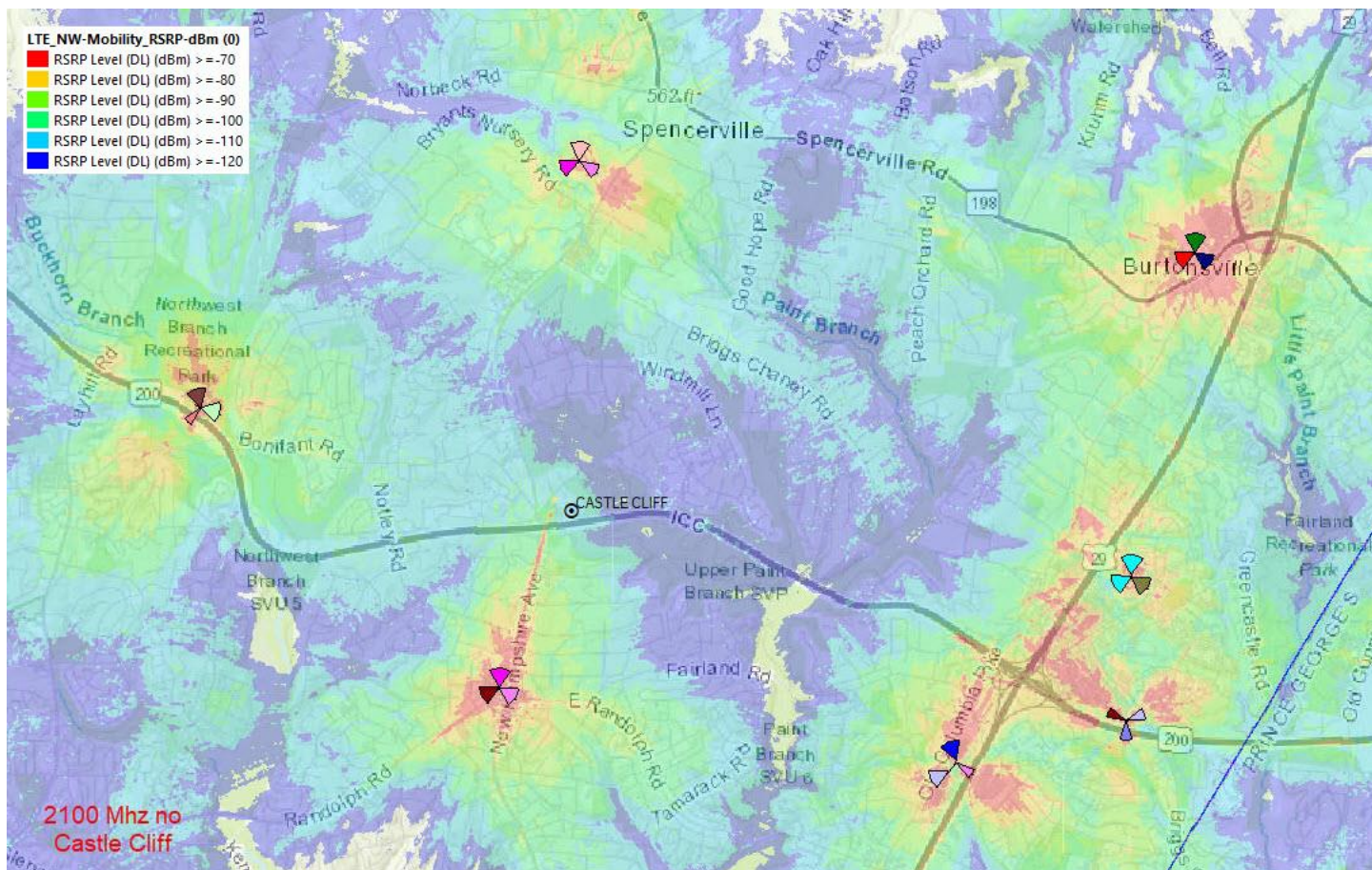
Site Name: Castle Cliff
Wireless Communication Facility
39°05'22.9"N 76°59'46.3"W
Silver Spring, MD 20904

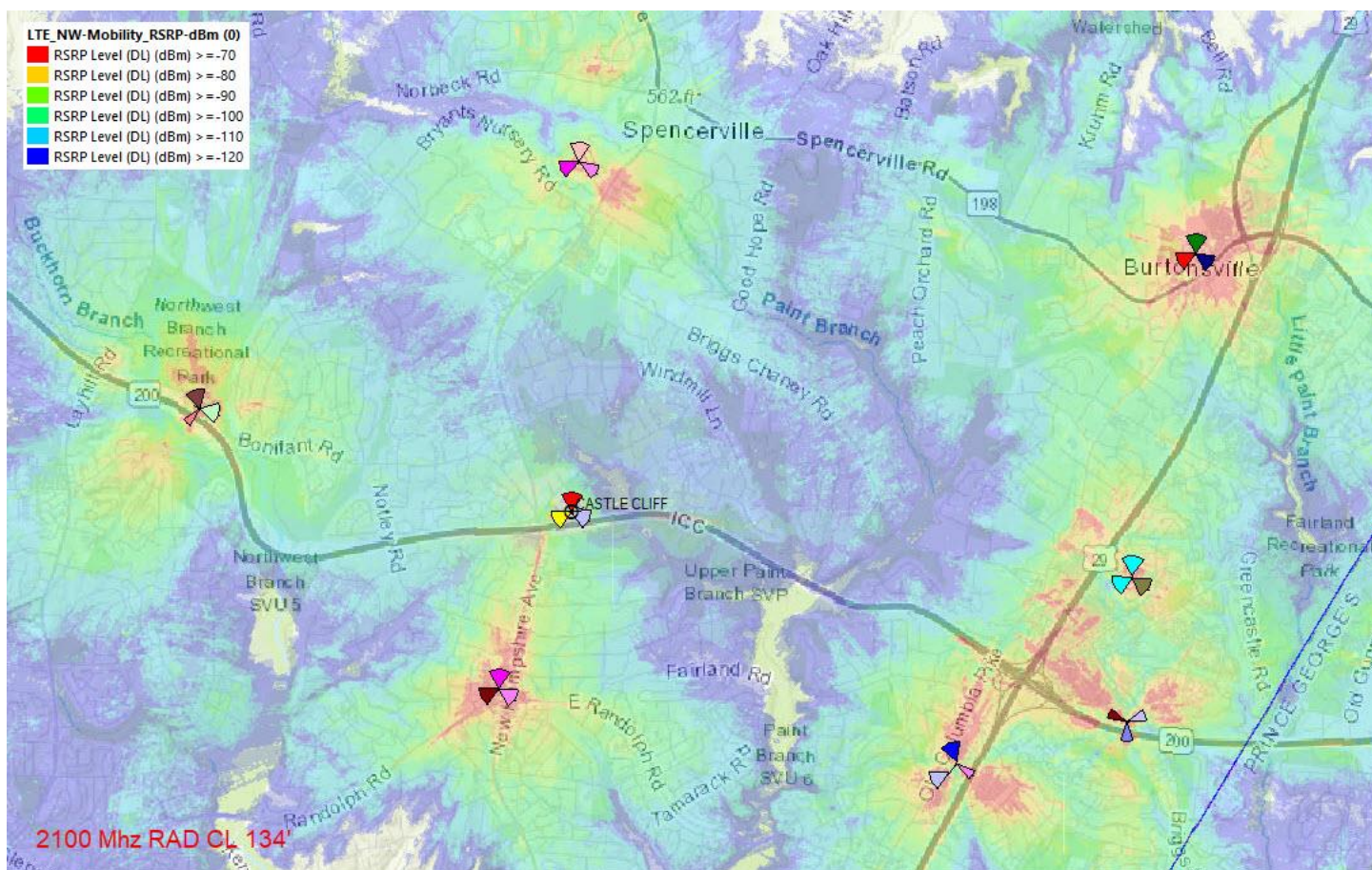
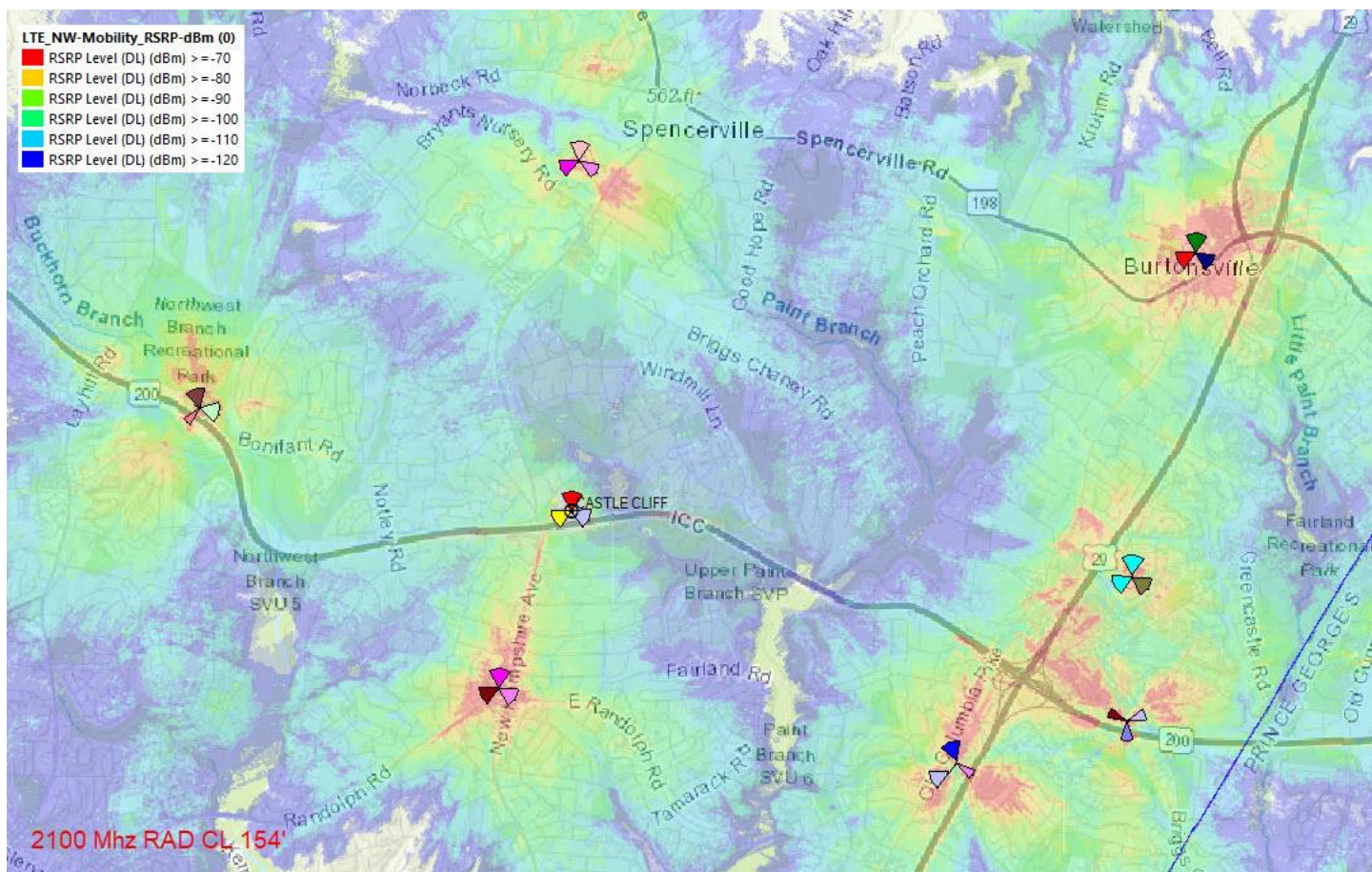
Photograph Information:
View 22-Good Hope Road &
Windmill Lane
View from the Northeast
Located .90 miles from Tower Site
SITE NOT VISIBLE





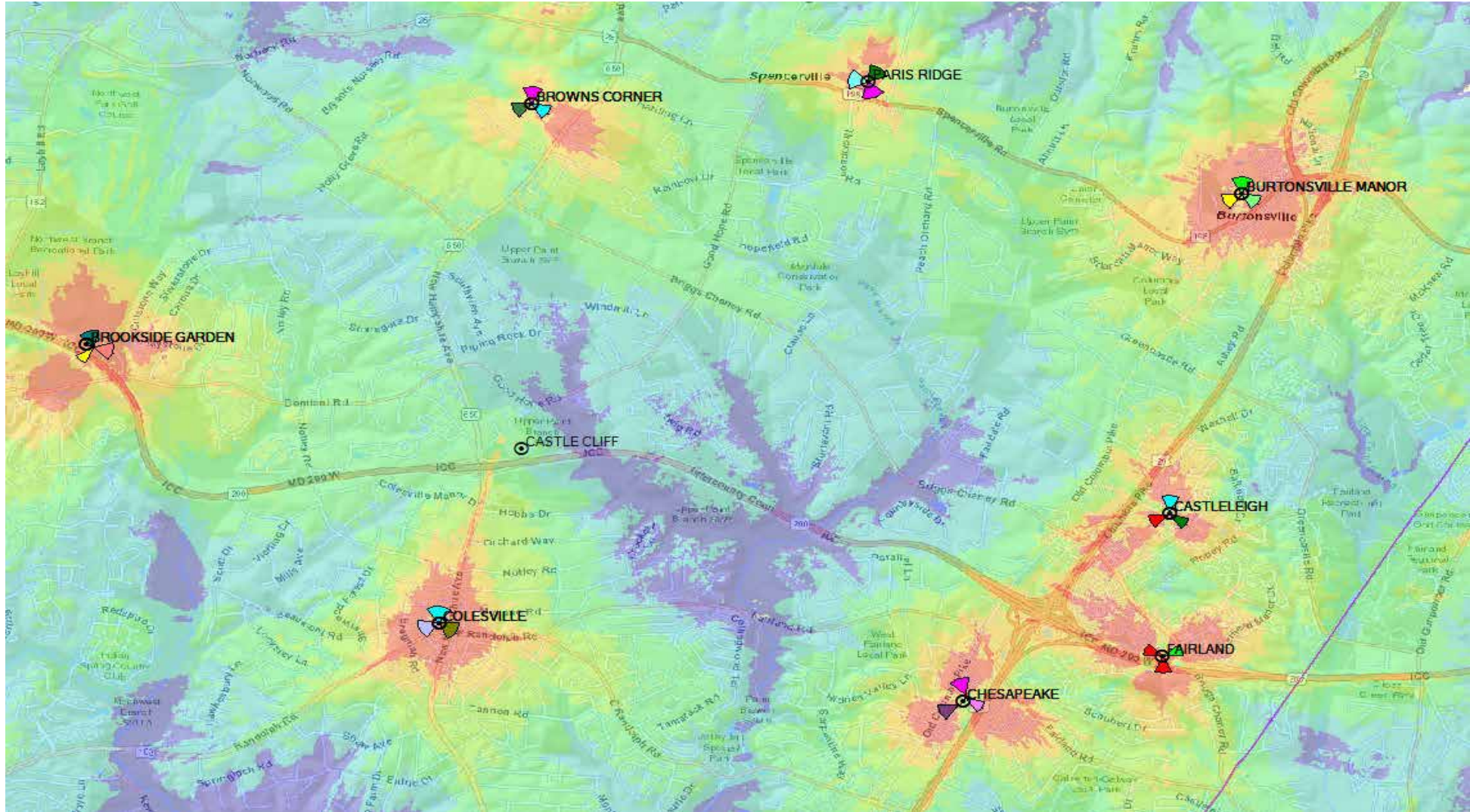




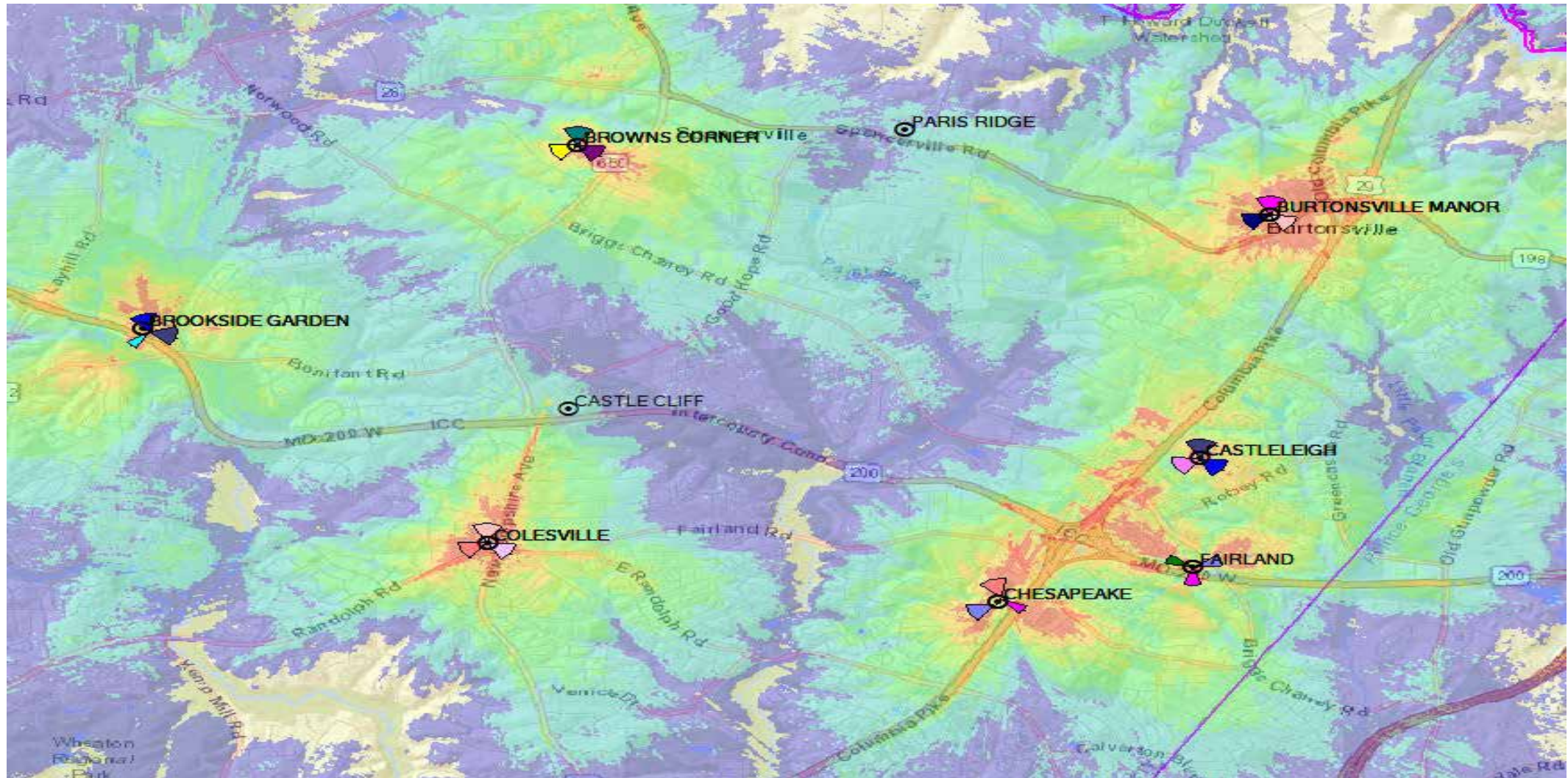


Verizon Castle Cliff RF Plots

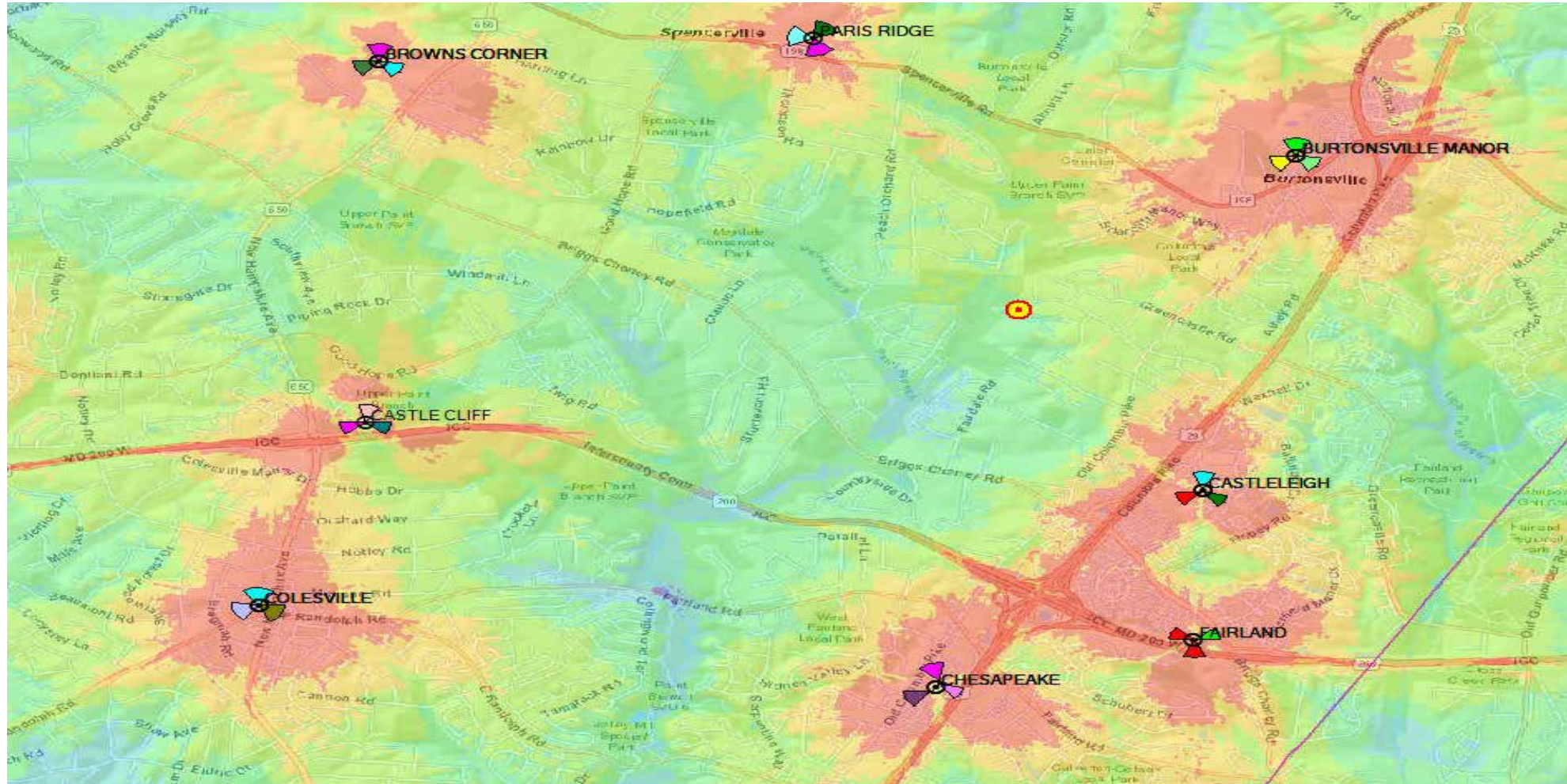
Verizon Castle Cliff Current 700Mhz Coverage



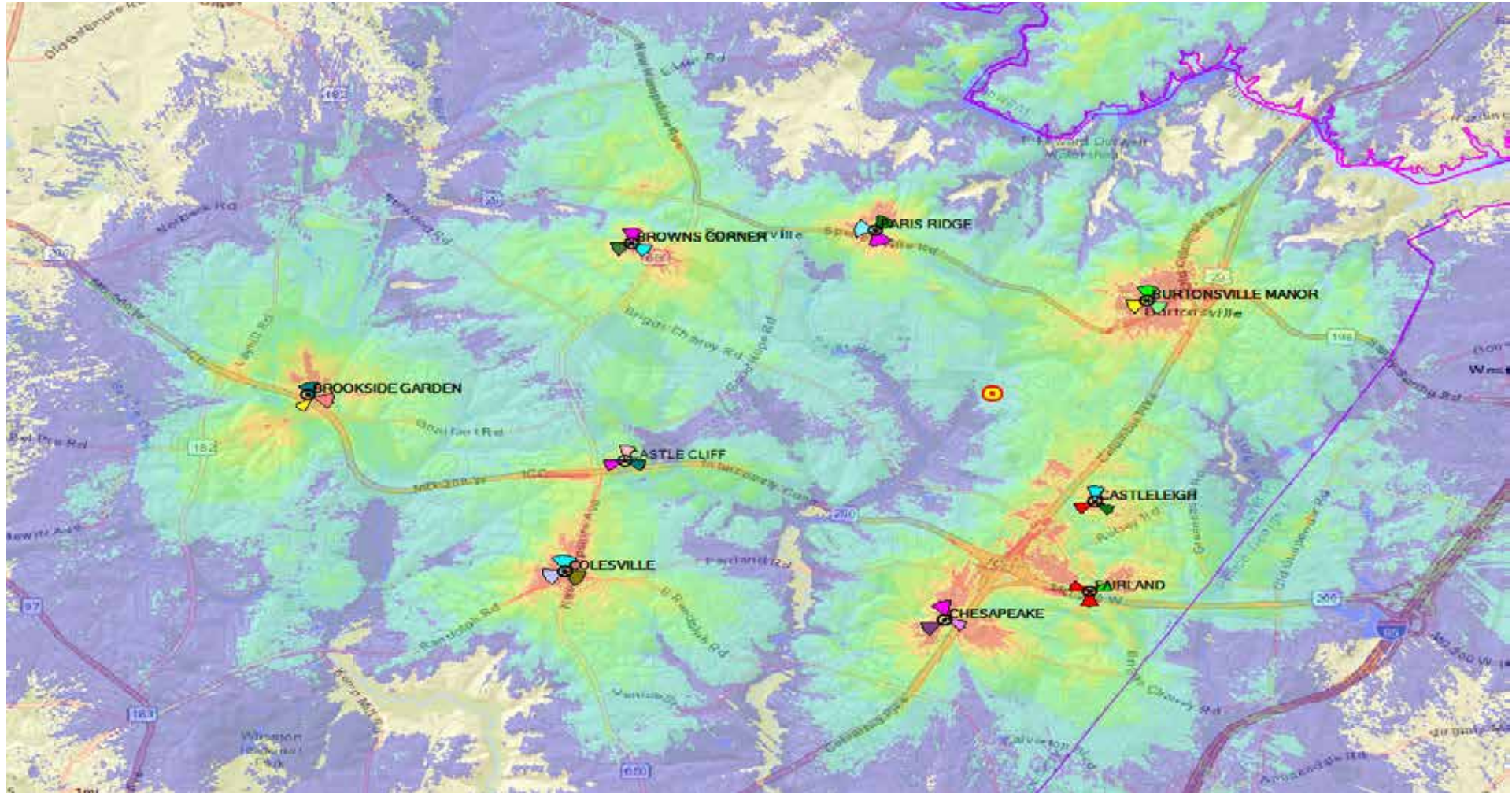
Verizon Castle Cliff current AWS coverage



Verizon 700Mhz coverage with Castle Cliff@ 174'



AWS coverage for Castle Cliff at 174'





DEPARTMENT OF GENERAL SERVICES

Marc Elrich
County Executive

David Dise
Director

December 6, 2024

To Whom It May Concern,

Montgomery County, Md is the fee simple owner of 14335 Cape May Rd, Silver Spring, MD 20904, a 11.73 Acre Parcel that is the home of the County's Colesville Maintenance Depot. The property ID is **District - 05 Account Number – 02257822**.

This letter hereby authorizes Network Towers II, LLC and Drew Patterson or Jim Golden, as authorized signatures, to sign and file any and all application documents, files and plans for the purpose of zoning, permitting and construction of a proposed wireless tower at this location.

This authorization includes preparing applications, plans, permits and all related materials needed to support the filing and processing of the applications and all supporting materials with the applicable governmental bodies.

Sincerely,

A handwritten signature in cursive script that reads "Gregory Ossont".

Greg Ossont
Deputy Director



December 12, 2024

Network Towers II, LLC
120 Eastshore Drive, Suite 300
Glen Allen, VA 23059

Re: Letter of Intent
New Tower at Colesville Maintenance Depot
14335 Cape May Road Silver Spring, MD 20904
AT&T Site Name: Tamarack (Site ID: 12922574)

To Whom It May Concern:

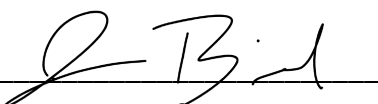
New Cingular Wireless PCS, LLC (AT&T) has engaged Smartlink Group to represent AT&T for all zoning, permitting, and other necessary governmental approvals needed for the AT&T site "Tamarack".

This letter hereby serves as a letter of intent that AT&T will co-locate on the tower proposed by Network Towers II, LLC, once installed.

It is AT&T's intention to co-locate on the tower to provide better coverage along Route 200.

Thank you for your attention to this matter.

Sincerely,

Signature: 

By: Jesse Bird

Its: Principle Tech Vendor Mgmt



December 12, 2024

Jim Golden
Network Building & Consulting
6095 Marshalee Drive, Suite 300
Elkridge, MD. 21075

Re: Castle Cliff - Proposed New Tower at 14335 Cape May Rd., Silver Spring, MD.

20904

Dear Mr. Golden:

T-Mobile, an FCC Licensed Cellular provider in the State of Maryland, is expressing its interest in leasing a proposed communication site called Castle Cliff.

T-Mobile has designed and constructed its wireless network in the Baltimore/Washington area. In order to maintain superior service, we continue to consider opportunities which will improve the network. This proposed location called Castle Cliff will enhance T-Mobile's wireless coverage in the surrounding areas.

This letter is only an expression of interest. The parties shall not be contractually bound unless and until they execute a formal lease, which must be in the form and content satisfactory to each party in their sole discretion. Neither party may rely on this letter as creating any legal obligation of any kind.

Sincerely,

Patrick Riordan

Patrick Riordan

Sr. Manager, Development | DC Eng & Ops

T-Mobile US, Inc.

12050 Baltimore Ave Suite 100, Beltsville, MD
20705

Mobile: (717) 645-9523

Email: patrick.riordan1@t-mobile.com

MILLENNIUM ENGINEERING, P.C.

42 Old Barn Drive
West Chester, Pennsylvania 19382

Cell: 610-220-3820
www.millenniumeng.com

Email: pauldugan@comcast.net

December 16, 2024

Attn: Jim Golden, Director- Strategic Programs
Network Towers II, LLC
6095 Marshalee Drive, Suite 300
Elkridge, MD 21075

Re: RF Safety FCC Compliance of Proposed Communications Facility

Site Name: Castle Cliff, Proposed 179' Monopole

Site Address: 14335 Cape May Road, Silver Springs, MD 20904 (Montgomery County)

Latitude 39° 05' 23.388" N, Longitude 76° 59' 46.482" W (NAD83), G.E. 454' +/- A.M.S.L.

Dear Mr. Golden,

I have performed an analysis to provide an independent determination and certification that the proposed Verizon Wireless communications facility at the above referenced property will comply with Federal Communications Commission (FCC) exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields (Code of Federal Regulation 47 CFR 1.1307 and 1.1310). As a registered professional engineer, I am under the jurisdiction of the State Registration Boards in which I am licensed to hold paramount the safety, health, and welfare of the public and to issue all public statements in an objective and truthful manner.

The proposed communications facility consists of a new 179' monopole at the above referenced property. The proposed antenna configuration consists of 9 total antennas (3 per sector) as follows:

- (6) multiband directional panel antennas (JMA Wireless MX06FHG865-HG or equivalent), (2) per sector at a centerline of 174 ft, azimuth of 5-115-240; transmitting from these antennas will be (1) 700 MHz LTE wideband channel, (1) 850 MHz LTE & 5G wideband channel, (1) 1900 MHz LTE wideband channel, (1) AWS 2100 MHz LTE wideband channel, and (2) AWS3 2100 MHz LTE wideband channels
- (3) LS6 5G panel antennas (Samsung MT6413-77A or equivalent), (1) per sector at a centerline of 174; azimuth of 5-115-240; transmitting from these antennas will be (1) LS6 3700 MHz 5G wideband channel

The following assumptions are made for reasonable upper limit radiofrequency operating parameters for the proposed facility due to the Verizon Wireless antennas alone:

- (2) 700/850/1900/2100/3500 MHz (LTE) multiband directional transmit antennas per sector
- (1) 3700 MHz 5G directional transmit antenna per sector
- (1) 700 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 850 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain
- (1) 1900 MHz LTE wideband channel at 4x40W max power/face before cable loss/antenna gain

- (1) 2100 MHz LTE AWS wideband channel at 4X40W max power/face before cable loss/antenna gain
- (2) 2100 MHz LTE AWS3 wideband channels at 4x40W max power/face before cable loss/antenna gain
- (1) 3700 MHz 5G wideband channel at 320W max power/face before cable loss/antenna gain
- The facility would be at or near full capacity during busy hour

Using the far-field power density equations from FCC Bulletin OET 65, the power density at any given distance from the antennas is equal to $0.360(ERP)/R^2$ where R is the distance to the point at which the exposure is being calculated. The given equation is a conversion of the OET 65 power density equation for calculating power density given the distance in feet and the result in metric units (mW/cm^2). This calculated power density assumes the location is in the main beam of the vertical pattern of the antenna. After making an adjustment for the reduction in power density due to the vertical pattern of the transmit antenna, the calculated ground level power density is well below 1 % of the FCC general population exposure limit at any distance from the antenna system of Verizon Wireless.

The 700 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $500 \mu W/cm^2$ or $0.5 mW/cm^2$. The 850 MHz transmit frequencies, which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $587 \mu W/cm^2$ or $0.587 mW/cm^2$. The 1900 MHz transmit frequencies which Verizon Wireless is licensed by the FCC to operate, have an uncontrolled/general population maximum permissible exposure (MPE) FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 2100 MHz which Verizon Wireless is also licensed by the FCC to operate, have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$. The 3700 MHz C-Band transmit frequencies have an uncontrolled/general population MPE FCC limit of $1000 \mu W/cm^2$ or $1 mW/cm^2$.

Therefore, the exposure at ground level at any distance from the structure would be substantially below 1 % of the FCC general population exposure limits due to Verizon Wireless antennas alone. The extremely low ground exposure levels are due to the elevated positions of the antennas in the structure and the low power which these systems operate. See Figures 1 and 2 in back of this report which discusses the relationship between height, proximity or distance, and orientation to level of electromagnetic field exposure.

In summary, the proposed communications facility will comply with all applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65). Federal law (FCC Rule Title 47 CFR 1.1307 and 1.1310) sets the national standard for compliance with electromagnetic field safety. The FCC exposure limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) and, over a wide range of frequencies, the exposure limits developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI). **Thus, there is full compliance with the standards of the IRPA, FCC, IEEE, ANSI, and NCRP.**

General Information on Electromagnetic Field Safety

Verizon Wireless facilities transmit and receive low power electromagnetic fields (EMF) between base station antennas and handheld devices (smart phones, ipads, laptops, jetpacks, etc.). The radiofrequency energy from these facilities and devices is non-ionizing electromagnetic energy. Non-ionizing, unlike X-Rays or other forms of potentially harmful energy in the microwave region, is not cumulative over time nor can the energy change the chemical makeup of atoms (e.g. strip electrons from ions). “Non-ionizing” simply means that the energy is not strong enough to break ionic bonds.

Safe levels of electromagnetic fields were determined by numerous worldwide organizations, such the International Committee for Non-Ionizing Radiation Protection, a worldwide multi-disciplinary team of researchers and scientists studying the effects of non-ionizing radiofrequency energy such as that emitted by base stations or cell phones. The FCC did not arbitrarily establish their own standards, but rather adopted the recommendations of all leading organizations that set standards and research the subject such as the Institute of

Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), and National Council on Radiation Protection and Measurements (NCRP).

When Verizon Wireless, or any commercial wireless communications licensee, is located on an antenna structure such as a self-supporting lattice type tower, monopole, guyed tower, watertank, etc. the antennas are typically 10 meters or more above ground level (10 meters = 32.81 feet). With the relatively low power and elevated positions of the antennas on the structure with respect to ground level, the maximum ground level exposure can rarely approach 1 % of the applicable FCC exposure limit regardless of how many sets of antennas are collocated on the structure. For this reason, the FCC considers the facilities “categorically excluded” from routine evaluation at antenna heights above 10 meters (or above 32.81 feet). Categorical exclusion exempts a site from routine on-site evaluation. However, the facility is not excluded from compliance with the federal exposure limits and guidelines. The types of facilities used by Verizon Wireless typically elevated on antenna structures (away from access to close proximity, i.e. greater than 10 meters or 32.81 feet) simply cannot generate ground level exposure levels that approach the limits under any circumstances.

From a regulatory perspective, the FCC has sole jurisdiction over the regulation of electromagnetic fields from all facilities and devices. The FCC has established guidelines and limits over emissions and exposure to protect the general public. The FCC also has certain criteria that trigger when an environmental evaluation must be performed. The criteria are based on distance from the antennas (accessibility) and transmit power levels.

CONCLUSIONS:

- 1) The proposed Verizon Wireless communications facility will comply with electromagnetic field safety standards by a substantial margin (well below 1 %) in all publicly accessible areas. This includes the base of the proposed structure and any areas in proximity to the structure.**
- 2) Verizon Wireless takes appropriate measures to ensure that all telecommunications facilities (including this proposed facility) comply with applicable exposure limits and guidelines adopted by the FCC governing human exposure to radiofrequency electromagnetic fields (FCC Bulletin OET 65).**
- 3) In cases where such compliance exists, the subject of electromagnetic field safety is preempted.** The Telecommunications Act of 1996 states that: “No state or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [FCC’s] regulations concerning such emissions.” Telecommunications Act of 1996, § 332[c][7][B][iv].

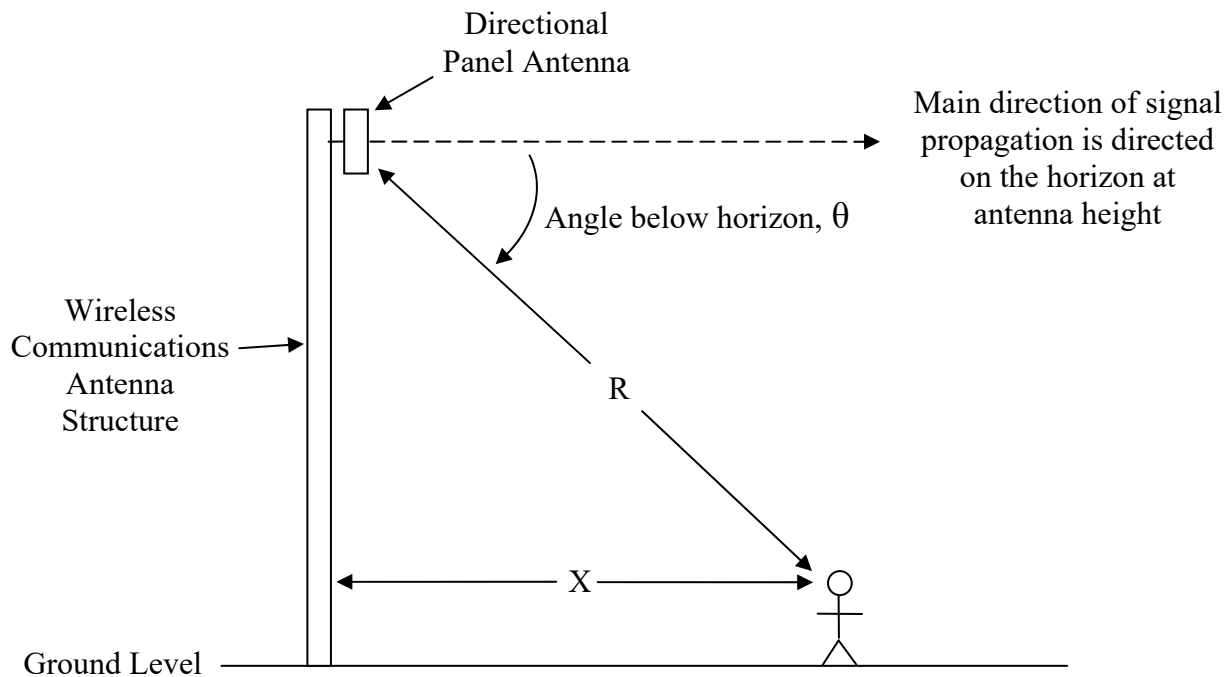
Respectfully,



Paul Dugan, P.E.
Registered Professional Engineer
Maryland License Number 24211

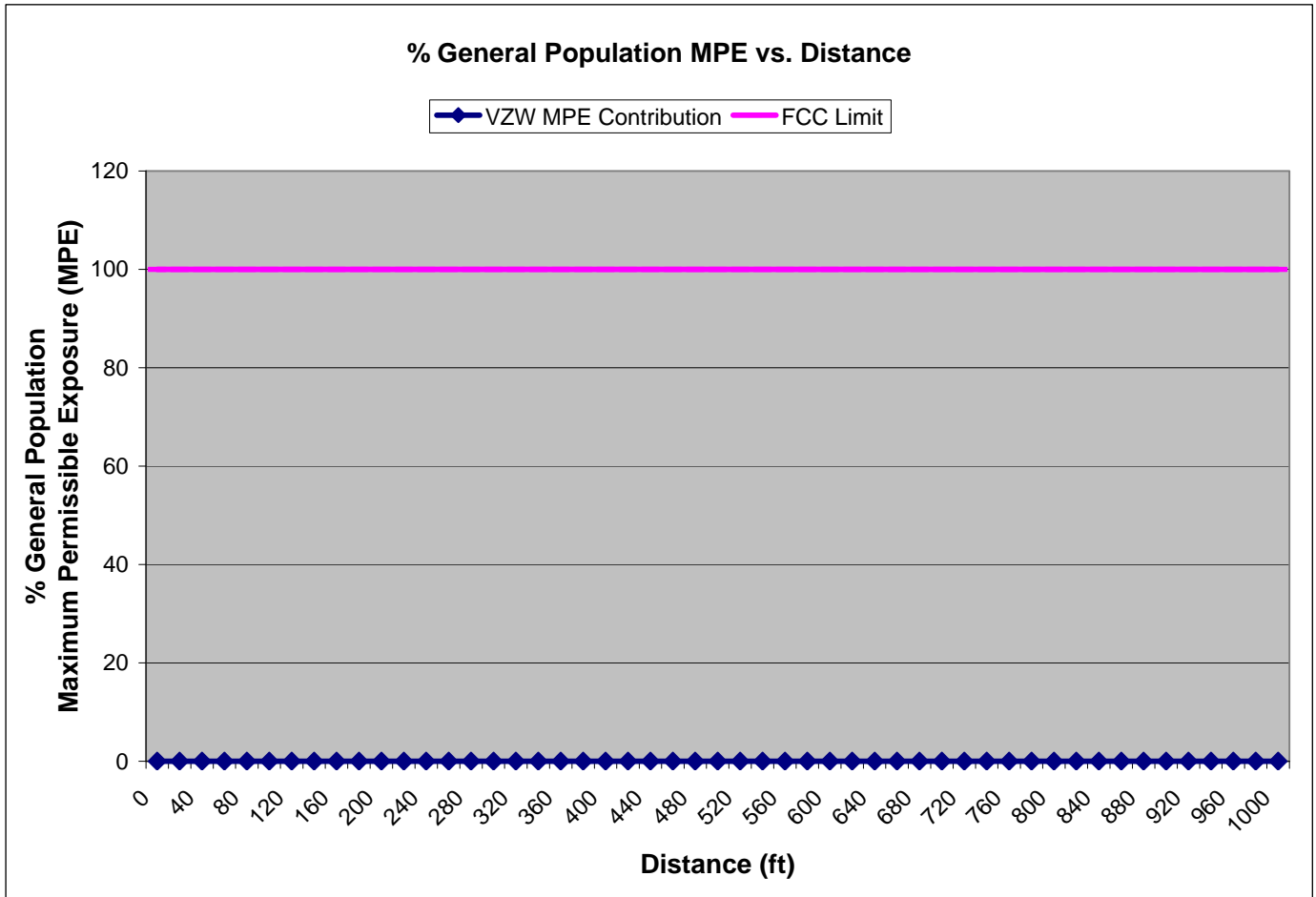


FIGURE 1: Diagram of Electromagnetic Field Strength as a Function of Distance and Antenna Orientation



The above diagram illustrates the conceptual relationship of distance and orientation to directional panel antennas used in wireless communications. At the base of the structure ($x = 0$), the distance R is a minimum when the angle of the direction of propagation θ is a maximum. As one moves away from the antenna structure, the horizontal distance X increases as well as the distance R to the antennas while the angle below the horizon decreases. For this reason, electromagnetic fields from these facilities remain fairly uniform up to a few hundred feet and continue to taper off with distance. As noted in the report, the electromagnetic fields from these types of facilities are hundreds of times below safety standards at any distance from the antenna structure, making them essentially indistinguishable relative to other sources of electromagnetic fields in the environment due to the elevated heights of the antennas and the relatively low power at which these systems operate.

FIGURE 2: Graph of MPE Contribution vs. Distance



The above graph represents the contribution of VZW to the composite electromagnetic field exposure level at any distance from the base of the structure. The contribution of VZW will remain well under 1% of the FCC general population maximum permissible exposure (MPE) at any distance as shown.

DECLARATION OF ENGINEER

Paul Dugan, P.E., declares and states that he is a graduate telecommunications consulting engineer (BSE/ME Widener University 1984/1988), whose qualifications are a matter of record with the Federal Communications Commission (FCC). His firm, Millennium Engineering, P.C., has been retained by Network Towers II LCC to perform power density measurements or calculations for an existing or proposed communications facility and analyze the data for compliance with FCC exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields.

Mr. Dugan also states that the calculations or measurements made in the evaluation were made by himself or his technical associates under his direct supervision, and the summary letter certification of FCC compliance associated with the foregoing document was made or prepared by him personally. Mr. Dugan is a registered professional engineer in the Jurisdictions of Pennsylvania, New Jersey, Delaware, Maryland, Virginia, New York, Connecticut, District of Columbia, West Virginia, Puerto Rico, and Colorado with 40 years of engineering experience. Mr. Dugan is also an active member of the Association of Federal Communications Consulting Engineers, the National Council of Examiners for Engineering, the National Society of Professionals Engineers, the Pennsylvania Society of Professional Engineers, and the Radio Club of America. Mr. Dugan further states that all facts and statements contained herein are true and accurate to the best of his own knowledge, except where stated to be in information or belief, and, as to those facts, he believes them to be true. He believes under penalty of perjury the foregoing is true and correct.


Paul Dugan, P.E.

Executed this the 16th day of December, 2024.

PAUL DUGAN, P.E.
42 Old Barn Drive
West Chester, PA 19382
Cell: 610-220-3820
Email: paul.mepc@gmail.com
Web Page: www.millenniumeng.com

EDUCATION: Widener University, Chester, Pennsylvania
Master of Business Administration, July 1991
Master of Electrical Engineering, December 1988
Bachelor of Science, Electrical Engineering, May 1984

PROFESSIONAL ASSOCIATIONS: **Registered Professional Engineer** in the following jurisdictions:

Pennsylvania, License Number PE-045711-E
New Jersey, License Number GE41731
Maryland, License Number 24211
Delaware, License Number 11797
Virginia, License Number 36239
West Virginia, License Number 20258
Connecticut, License Number 22566
New York, License Number 079144
District of Columbia, License Number PE-900355
Puerto Rico, License Number 18946
Colorado, License Number PE.0065295

Full member of **The Association of Federal Communications Consulting Engineers**
(www.afcce.org) January 1999 to Present

Elected and served on the Board of Directors for five year term 2006-2011

Full member of **The National Society of Professional Engineers** (www.nspe.org) and the **Pennsylvania Society of Professional Engineers** (www.pspe.org) June 2003 to Present
Currently serving as PSPE State Director and Past President on the Board of Directors of the Valley Forge Chapter and the South East Region Vice-Chair for the "Professional Engineers in Private Practice" Executive Committee. Actively participated in NSPE Annual Conferences 7/2005 to Present.

Actively participate in **Chester County ARES/RACES Amateur Radio** (CCAR www.w3eoc.org) which prepares and provides emergency backup communications for Chester County Department of Emergency Services, March 2005 to Present

Full member of **The National Council of Examiners for Engineering**
(www.ncees.org) May 2001 to Present

Full Member of **The Radio Club of America**
(www.radio-club-of-america.org) December 2003 to Present

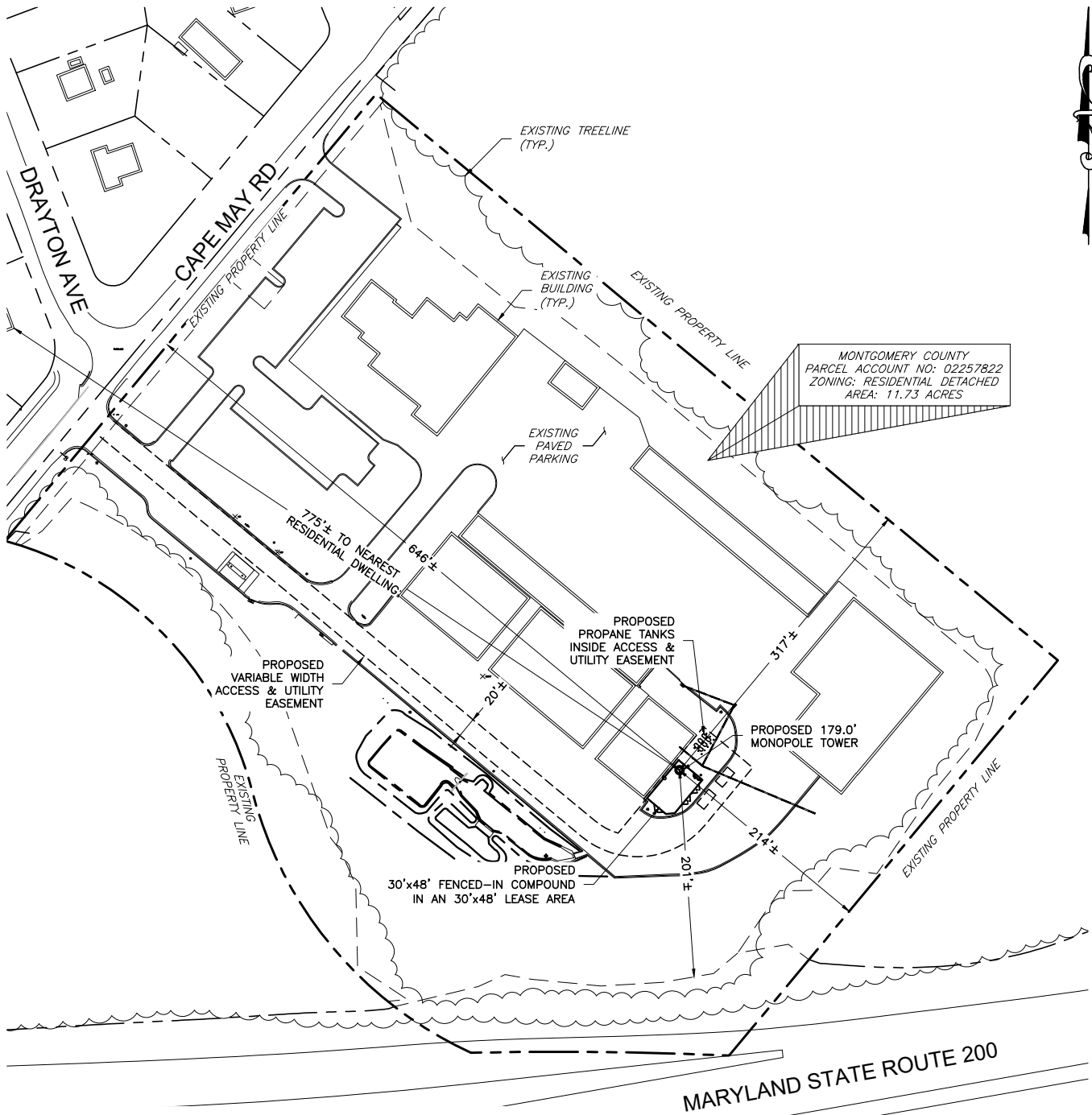
Pennsylvania Real Estate License Number RS347405 Keller Williams 2/2019 to Present

PROFESSIONAL EXPERIENCE: Millennium Engineering, P.C., West Chester, Pennsylvania
Position: **President**, August 1999 to Present (www.millenniumeng.com)

Verizon Wireless, Plymouth Meeting, Pennsylvania
Position: **Cellular RF System Design/Performance Engineer**, April 1990 to August 1999

Communications Test Design, Inc., West Chester, Pennsylvania
Position: **Electrical Engineer**, May 1984 to April 1990

PERSONAL: Date/place of birth: November 21, 1961, West Chester, Pennsylvania; United States Citizen



PROPERTY INFORMATION

OWNER: MONTGOMERY COUNTY
OWNER ADDRESS: EOB 101 MONROE ST
ROCKVILLE, MD 20850
PARCEL ID: 02257822
ZONING: RESIDENTIAL DETACHED
AREA: 11.73 ACRES

PROPERTY PLAN



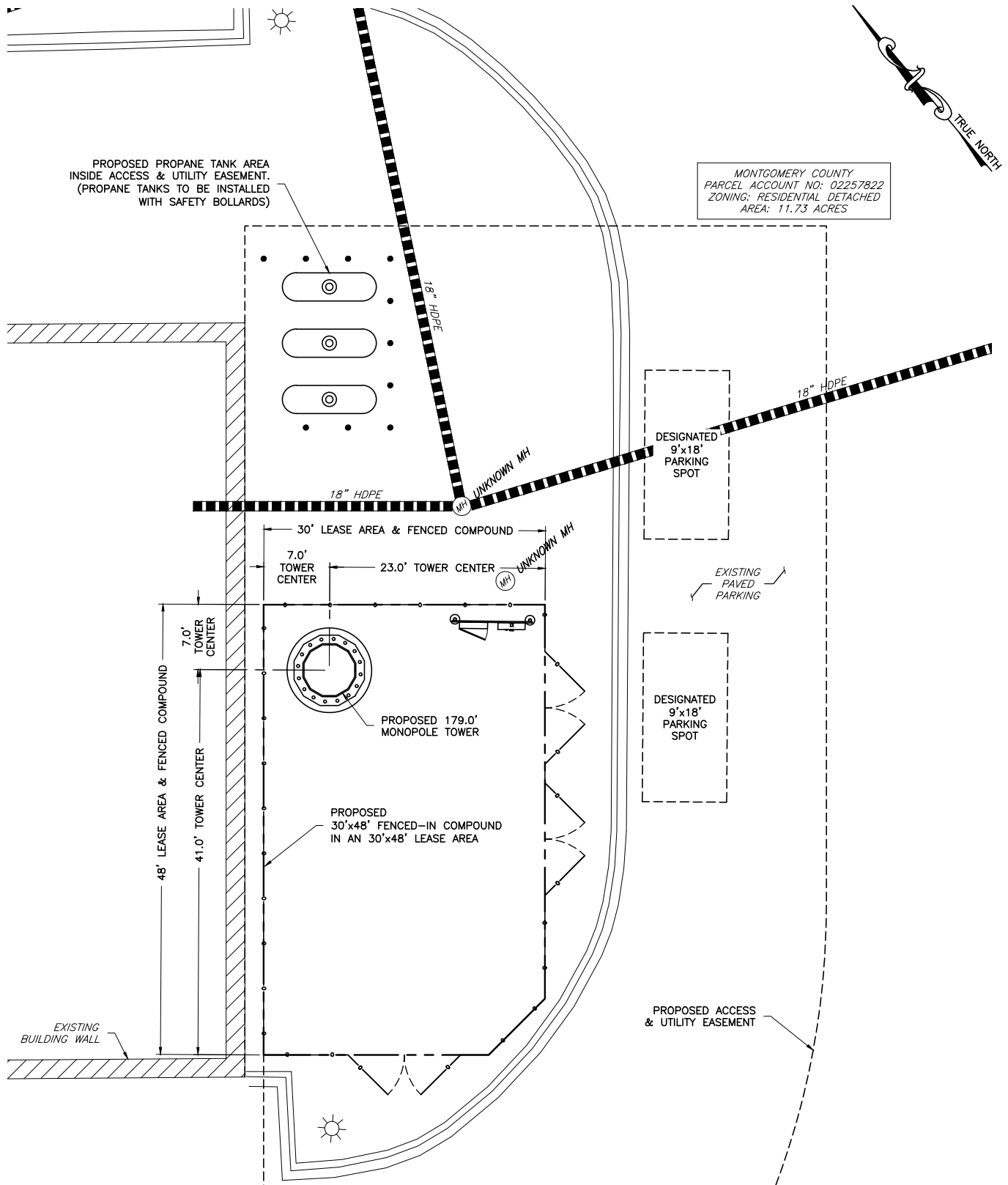
"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRINGS, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -
LAT (NAD 83): 39.0897°
LONG (NAD 83): -76.9962°

SHEET 1

11/22/2024
BY: OP



COMPOUND PLAN



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRINGS, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

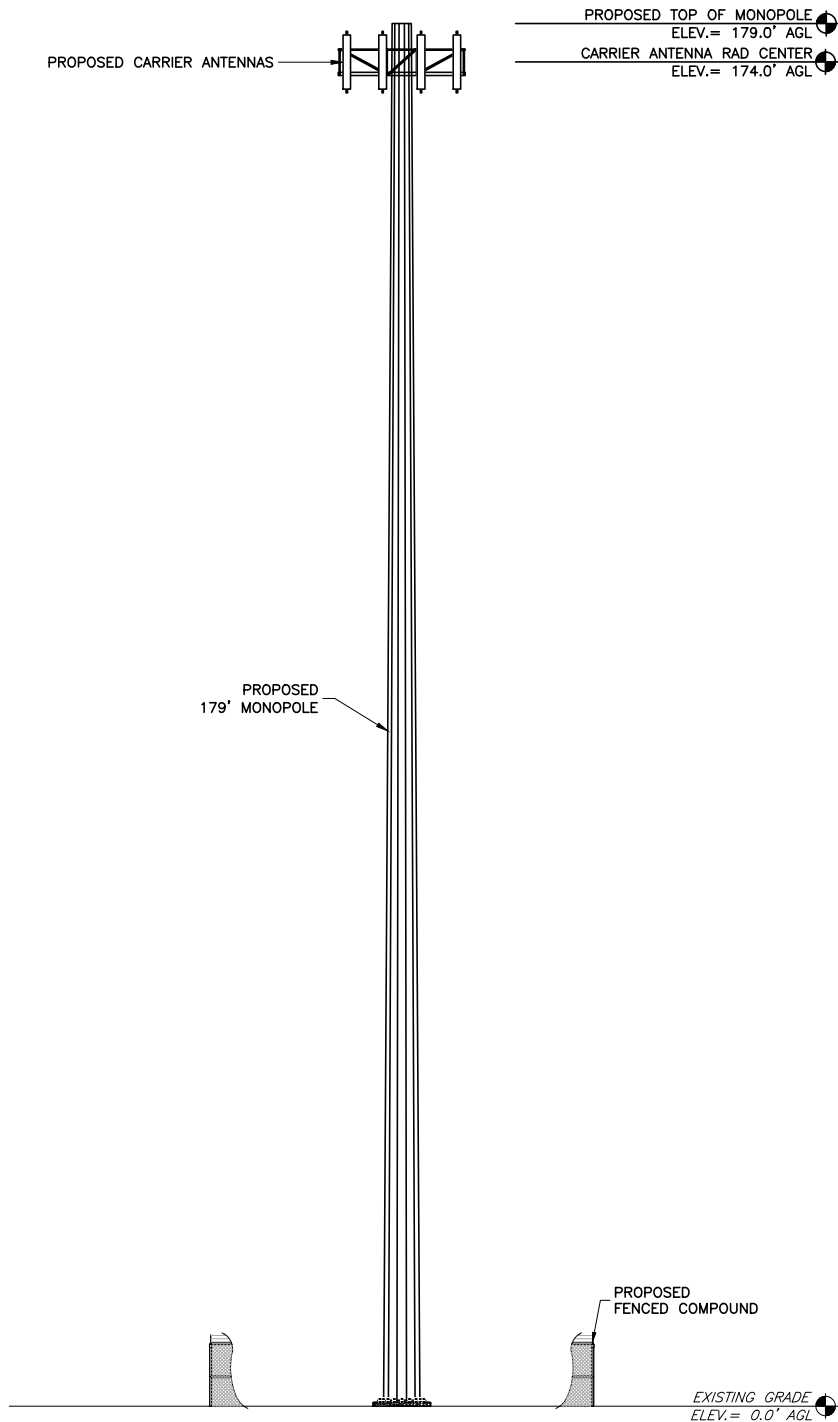
SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

SHEET 2

11/22/2024
BY: OP



ELEVATION



"CASTLE CLIFF"
(911 ADDRESS TBD)
14335 CAPE MAY RD.
SILVER SPRINGS, MD 20904
MONTGOMERY COUNTY

SITE INFORMATION

SITE VISIT BY: - DATE: -

LAT (NAD 83): 39.0897°

LONG (NAD 83): -76.9962°

SHEET 3

11/22/2024
BY: OP