

EXHIBIT E

Radio Frequency Analysis Report

CT3439
99 Dart Hill Road, South Windsor, CT



February 6, 2023



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1. Overview

C Squared Systems was retained by New Cingular Wireless PCS, LLC (“AT&T”) to evaluate the proposed wireless communications facility at 99 Dart Hill Road in South Windsor to allow AT&T to install its antennas at 150 feet AGL.

AT&T is licensed by the FCC to provide wireless communications services throughout the State of Connecticut including the Town of South Windsor where the proposed facility would be located.

This report addresses AT&T’s need for the proposed wireless facility and confirms that there are no other suitable existing structures available that could address the coverage gaps in their wireless communications network.

The coverage analysis completed by C Squared Systems confirms: AT&T has a gap in reliable service in South Windsor, and that the Proposed Facility provides AT&T with coverage in that service gap. Included as attachments in this report are coverage maps detailing the existing network and expected coverage from the proposed facility, pertinent site information, terrain and network layout maps.

2. Technology Advances & Design Evolution

AT&T provides digital voice and data services using advanced 4th Generation (4G) services over LTE technology in the 700 MHz, 850 MHz, 1900 MHz, 2100 MHz and 2300 MHz frequency bands as allocated by the FCC. 5th Generation (5G) services are also being selectively rolled out on available frequencies in the 850 MHz, 1900 MHz, 2100 MHz and 2300 MHz bands. These data networks are used by mobile devices for fast web browsing, media streaming, and other applications that require broadband connections. The mobile devices that benefit from these advanced data networks are not limited to basic handheld phones, but also include devices such as smartphones, PDA’s, tablets, and laptop air-cards. 4G LTE services and devices have enabled AT&T customers to have even faster connections to people, information, and entertainment.

AT&T will also deploy FirstNet services from this facility. FirstNet is a federal agency with a mandate to create a nationwide, interoperable public safety broadband network for first responders. First responders across the country currently rely on more than 10,000 separate radio networks which oftentimes do not interoperate with one another. By deploying a nationwide broadband public safety network built specifically to meet the communications needs of first responders, the FirstNet network will provide a solution to the decades-long interoperability and communications challenges first responders have experienced, and which was highlighted by the 9/11 Commission’s 2004 Final Report.

FirstNet selected AT&T to build, manage and operate the National Public Safety Broadband Network (“NPSBN”) using FirstNet’s Band 14 spectrum (Call Sign WQQE234, 20 MHz of the 700 MHz spectrum), together with AT&T’s own wireless network. Using a combination of new and existing wireless facilities, AT&T provides prioritized, preemptive wireless services for first responders across Connecticut, New England and nationwide, while also improving 4G LTE coverage for AT&T customers.

AT&T’s 4G LTE technology is designed to thresholds of -83 dBm and -93 dBm for their 700 MHz LTE and -86 dBm and -96 dBm for their 1900 MHz LTE.¹ The stronger thresholds (-83 dBm and -86 dBm) yield greater throughputs and improved customer experience. The -93 dBm and -96 dBm thresholds are the minimum acceptable levels required to meet customer expectations for 4G service.

¹ The threshold range differences between the 700 MHz and 1900 MHz frequency bands directly correlates to the type of branch diversity receivers deployed in AT&T’s receiver design.

3. Coverage Objective

There is a significant coverage deficiency in the existing AT&T wireless communications network along State Hwy 74, Avery Street, Dart Hill Road and Miller Road as well as other roads in the area and in the vicinity of the proposed location, referred to herein as the "targeted area". A deficiency in coverage is evidenced by the inability to adequately and reliably transmit/receive quality calls and/or utilize data services offered by the network. Seamless reliable coverage provides users with the ability to successfully originate, receive, and maintain quality calls and data applications throughout a service area. Appropriate overlapping coverage is required for users to be able to move throughout the service area and reliably "hand-off" between cells to maintain uninterrupted connections.

Due to terrain characteristics and the distance between the targeted area and the existing sites, AT&T's options to provide services in this area are quite limited (maps of the terrain in this area and the distance to neighboring AT&T sites from the proposed site are included as Attachments 1 & Table 2, respectively.). AT&T's network requires deployment of antennas throughout the area to be covered. These antennas are connected to receivers and transmitters that operate in a limited geographic area known as a "cell." AT&T's wireless network, including their wireless handsets and devices, operate by transmitting and receiving low power radio frequency signals to and from these cell sites. The signals are transferred to and from the landline telephone network and routed to their destinations by sophisticated electronic equipment. The size of the area served by each cell site is dependent on several factors, including the number of antennas used, the height at which the antennas are deployed, the topography of the land, vegetative cover and natural or man-made obstructions in the area. As customers move throughout the service area, the transmission from the portable devices is automatically transferred to the AT&T facility with the best connection to the device, without interruption in service provided that there is overlapping coverage from the cells.

In order to define the extent of the coverage gap to be filled, propagation modeling has been conducted in the area of South Windsor. Propagation modeling uses PC software to determine the network coverage based on the specific technical parameters of each site including, but not limited to, location, ground elevation, antenna models, antenna heights, and also databases of terrain and ground cover in the area. Drive testing consists of traveling along area roadways in a vehicle equipped with a sophisticated setup of test devices and receivers that collect a variety of network performance metrics. The data are then processed and mapped in conjunction with the propagation modeling to determine the coverage gaps.

Analysis of the propagation modeling in South Windsor reveal that AT&T's network is unreliable throughout much of the area due to gaps in coverage, and that there is a service deficiency as a result. In order to fill in these coverage gaps and improve the network reliability to South Windsor, a new facility is needed in the area.

Included in this report are Attachments 1 through 5, which are explained below to help describe AT&T's 4G network deployment in and around South Windsor, and the need for the proposed facility.

- Attachment 1: “*CT3439 Area Terrain Map*” details the terrain features around the area of deficient service being targeted by the proposed site in South Windsor. These terrain features play a key role in determining site designs and dictating the unique coverage achieved from a given location. This map is included to provide a visual representation of the ridges and valleys that must be considered when siting a wireless facility. The blue, cyan, green and yellow shades correspond to lower elevations, whereas the orange, red, grey and white shades indicate higher elevations.
- Attachment 2: “*CT3439 Neighbor Site Data*” provides site specific information of existing neighboring sites used to perform the coverage analysis provided in Attachments 3 and 4.
- Attachment 3: “*CT3439 Existing 700 MHz LTE Coverage for the Current AT&T Network*” depicts 700 MHz LTE coverage from existing sites and demonstrates that there are currently gaps in 700 MHz LTE coverage effecting service within the targeted area. The coverage shown is where the signal strengths are: > -83 dBm (minimum level required reliable, high quality service and performance at 700 MHz) and, > -93 dBm (minimum required for adequate level of service at 700 MHz). In an effort to provide the required levels of coverage to these areas, AT&T is proposing to install a wireless facility at the Dart Hill Road location.
- Attachment 4: “*CT3439 Existing 700 MHz LTE Coverage with Proposed Site*” shows how this proposed site would fill in the existing coverage gaps and improve AT&T's 700 MHz LTE network.
- Attachment 5: Connecticut DOT Average Annual Daily Traffic Data – South Windsor shows the available vehicular traffic volume data for the subject area from the Connecticut Department of Transportation. These data show as many as 5,900 vehicles per day passing through State Hwy 74 in the vicinity of the proposed facility.

Table 1 below lists the coverage statistics compiled for the AT&T's 700 MHz 4G LTE network with the deployment of the Proposed Site.

	Incremental Coverage from Proposed Site (700 MHz)	
Population:²	(\geq -83 dBm)	1489
	(\geq -93 dBm)	4687
Business Pops:³		
	(\geq -83 dBm)	31
	(\geq -93 dBm)	191
Area (mi²):		
	(\geq -83 dBm)	1.15
	(\geq -93 dBm)	3.2
Roadway (mi):		
	Main (-93 dBm):	2.27
	Secondary (-93 dBm):	24.8
	Total (-93 dBm):	27.07

Table 1: Coverage Statistics

² Population figures are based upon 2020 US Census Block Data

³ Employee population counts are based upon the 2019 U.S. Census Bureau LEHD database.

4. Pertinent Site Data

Table 2 below details the site-specific information for the on-air AT&T macro-sites used to perform the coverage analysis and generate the coverage plots provided herein.

Site Name	Address	Town	Latitude	Longitude	Antenna Centerline (feet)	Structure Type	Status
CT1003	391 Niederwerfer Road	South Windsor	41.8636	-72.5231	77	Monopole	On-Air
CT1093	47 Main Street	Talcottville	41.8206	-72.5006	107	Watertank	On-Air
CT1135	300 Governors Highway	South Windsor	41.8335	-72.6030	162	Monopole	On-Air
CT1139	151 Sand Hill Road	South Windsor	41.8360	-72.5520	170	Monopole	On-Air
CT1140	50 Plantation Road	East Windsor	41.8756	-72.5648	111	Watertank	On-Air
CT1194	232 South Main Street	East Windsor	41.8772	-72.6108	170	Lattice	On-Air
CT5307	53-73 Skater Street	Manchester	41.8050	-72.5336	145	Monopole	On-Air
CT5308	281 Hartford Turnpike	Vernon Rockville	41.8268	-72.4932	50	Rooftop	On-Air
CT5323	209 Buckland Hills Drive	Manchester	41.8099	-72.5467	129	Watertank	On-Air
CT5328	777 Talcottville Road	Vernon	41.8633	-72.4834	147	Monopole	On-Air
CT1082	197 South Street	Windsor	41.8535	-72.4521	163	Monopole	On-Air
CT5310	60 Industrial Park Road	Windsor	41.8353	-72.4550	168	Monopole	On-Air
CT3439	99 Dart Hill Road	South Windsor	41.8471	-72.5202	150	Monopole	Proposed

Table 2: AT&T Mobility Site Information Used in Coverage Analysis ⁴

⁴ Some sites listed in this table are outside the plot view but are included for completeness of information.

5. Conclusion

AT&T has identified an area of deficient coverage affecting a significant portion of South Windsor CT, including key traffic corridors through the residential and business/retail areas of the Town. The proposed extension to the existing South Windsor facility will bring the needed fill-in coverage to significant portions of State Hwy 74, Avery Street, Dart Hill Road and Miller Road as well as other roads in the area and to the vicinity of the proposed location.

No other existing structures were identified and available that would be able to satisfy the coverage requirements needed for this area.

6. Statement of Certification

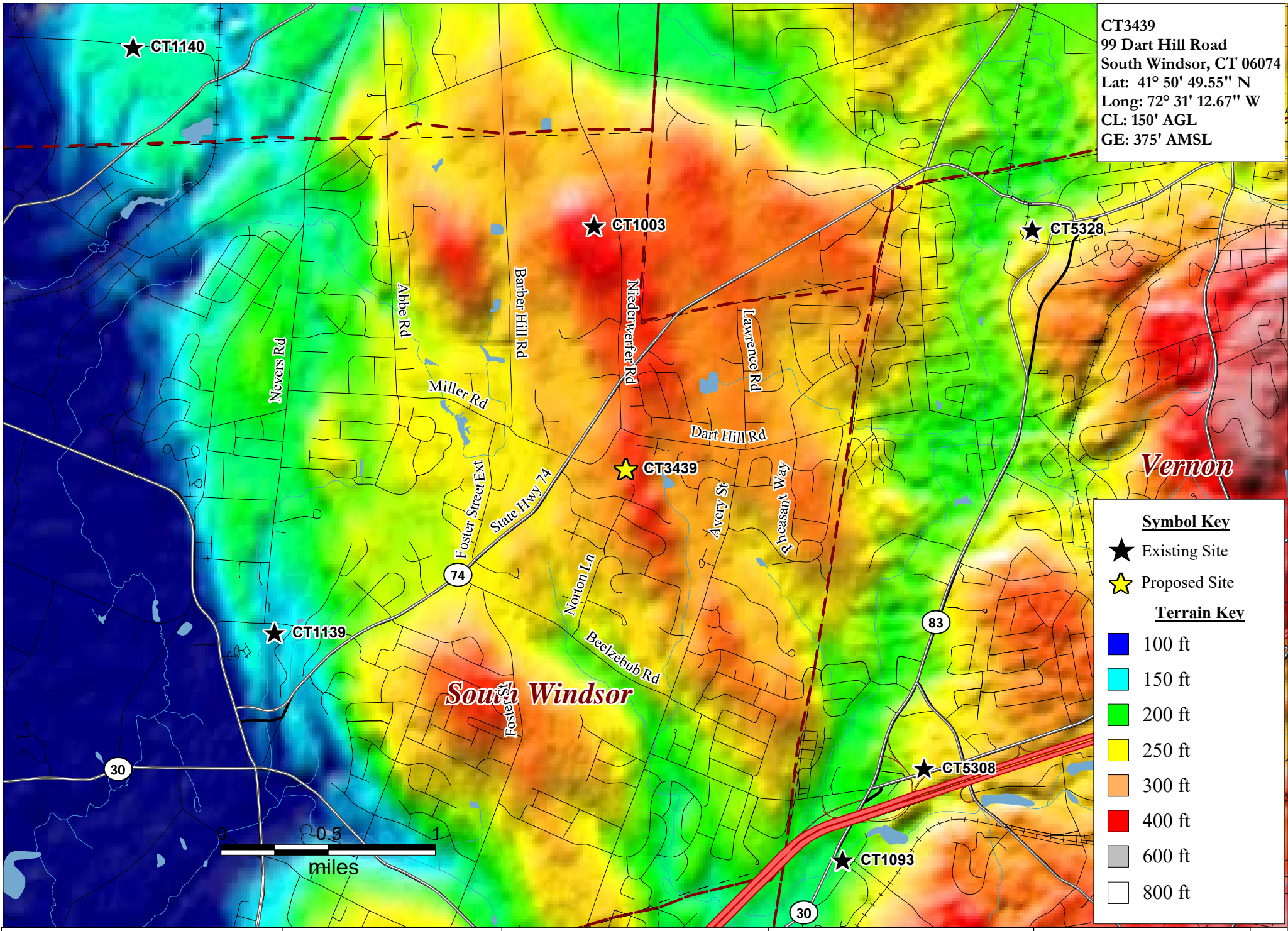
I certify to the best of my knowledge that the statements in this report are true and accurate.



Martin J. Lavin
C Squared Systems, LLC

February 6, 2023

Date



CT3439
 99 Dart Hill Road
 South Windsor, CT 06074
 Lat: 41° 50' 49.55" N
 Long: 72° 31' 12.67" W
 CL: 150' AGL
 GE: 375' AMSL

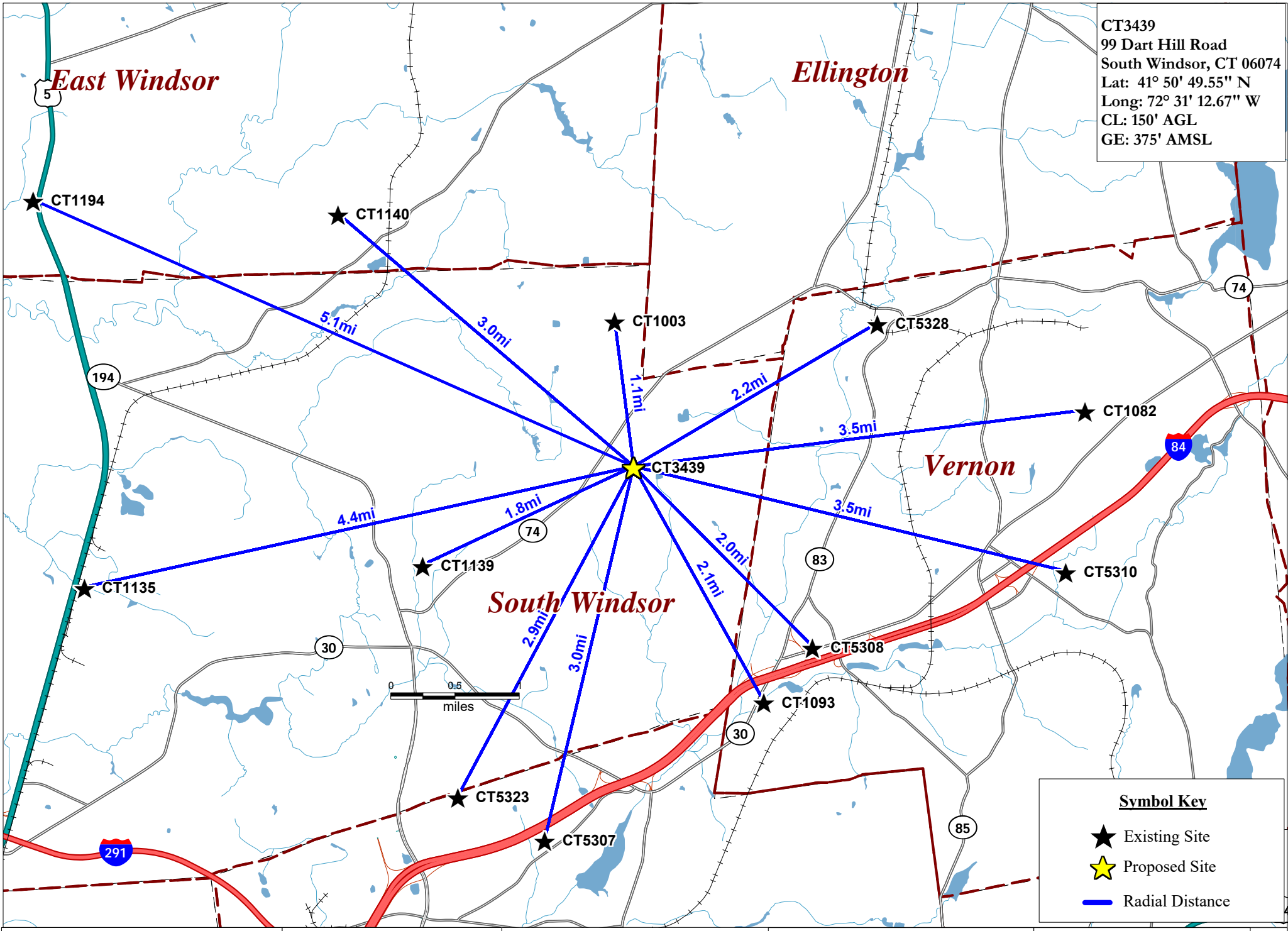
Symbol Key

- ★ Existing Site
- ★ Proposed Site

Terrain Key

- 100 ft
- 150 ft
- 200 ft
- 250 ft
- 300 ft
- 400 ft
- 600 ft
- 800 ft





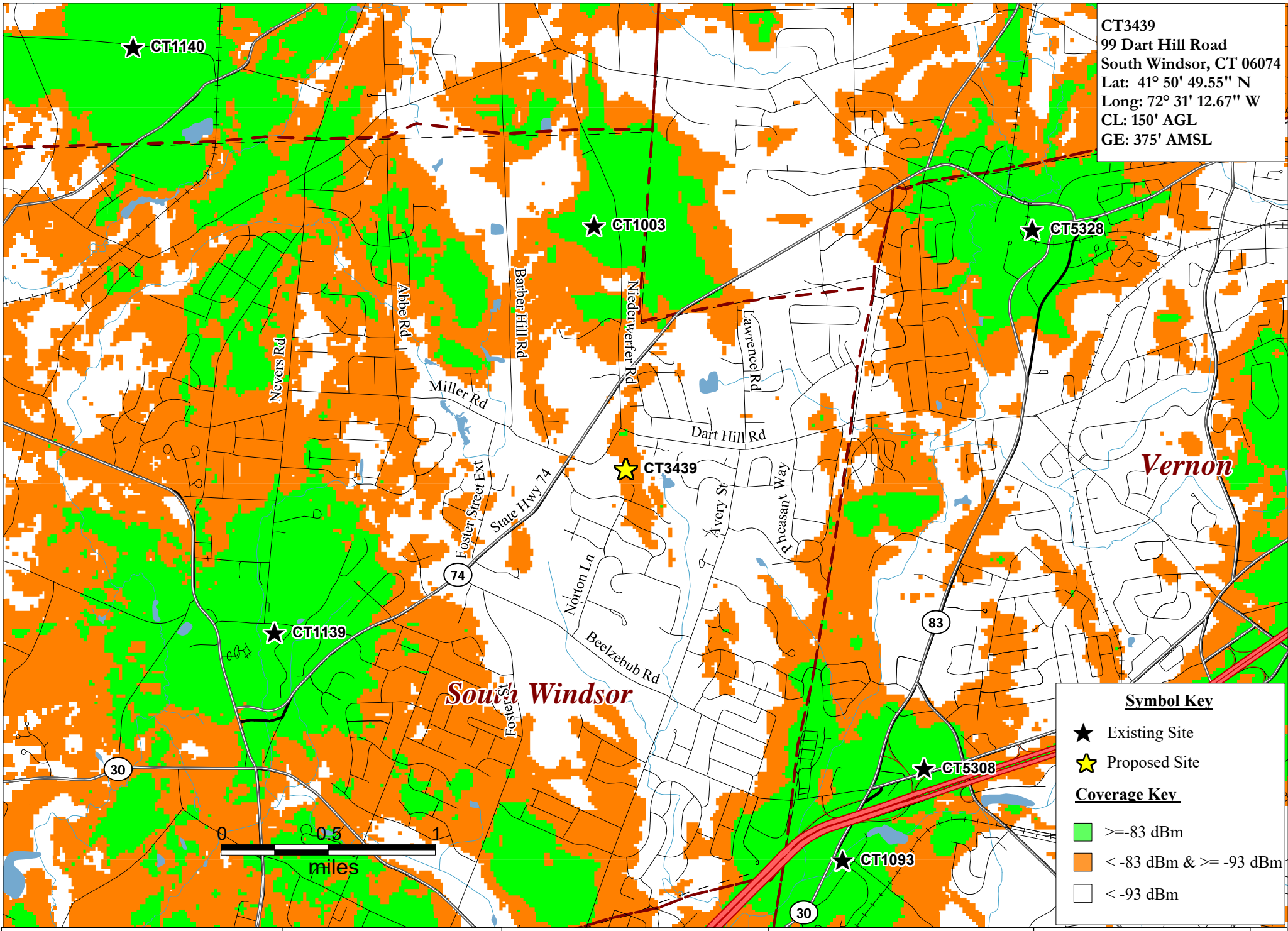
Neighbor Sites

CT3439

99 Dart Hill Road
 South Windsor, CT 06074



PREPARED ON	
DATE: 02/02/2023	REV 0



CT3439
 99 Dart Hill Road
 South Windsor, CT 06074
 Lat: 41° 50' 49.55" N
 Long: 72° 31' 12.67" W
 CL: 150' AGL
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Symbol Key

- ★ Existing Site
- ★ Proposed Site

Coverage Key

- Green: ≥ -83 dBm
- Orange: < -83 dBm & ≥ -93 dBm
- White: < -93 dBm

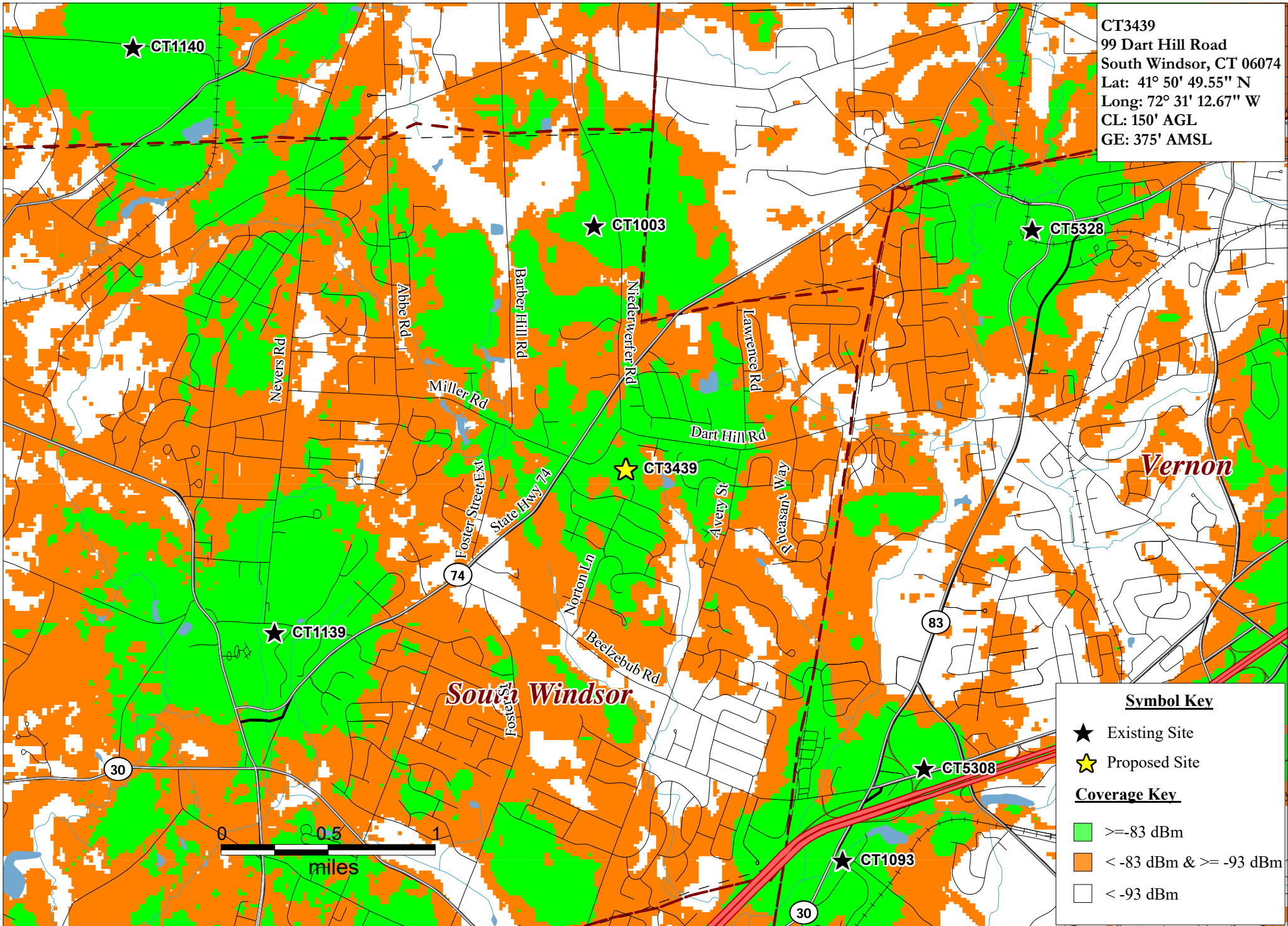
Existing Coverage
700 MHz LTE

CT3439

99 Dart Hill Road
South Windsor, CT 06074



PREPARED ON _____
 DATE: 02/02/2023
 REV 0



CT3439
 99 Dart Hill Road
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 Lat: 41° 50' 49.55" N
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Symbol Key

- ★ Existing Site
- ★ Proposed Site

Coverage Key

- Green: ≥ -83 dBm
- Orange: < -83 dBm & ≥ -93 dBm
- White: < -93 dBm



Existing & Proposed Coverage
700 MHz LTE

CT3439

99 Dart Hill Road
South Windsor, CT 06074



PREPARED ON _____
 DATE: 02/02/2023
 REV 0



★ CT3439