Wind Power GeoPlanner™

Mobile Phone Carrier Report

High Bridge Wind Farm

Prepared on Behalf of
Calpine Corporation

February 19, 2019

COMSEARCH®
A CommScope Company

Table of Contents

1. Introduction **- 1 -**

2. Summary of Results **- 2 -**

3. Contact Us **- 9 -**

1. Introduction

Comsearch has developed and maintains comprehensive technical databases containing information on licensed mobile phone carriers across the US. Mobile phone carriers operate in multiple frequency bands and are often referred to as Advanced Wireless Service (AWS), Personal Communication Service (PCS), 700 MHz Band, Wireless Communications Service (WCS), and Cellular. They hold licenses on an area-wide basis which are typically comprised of several counties.

This report focuses on the potential impact of wind turbines on mobile phone operations in and around the project area. Comsearch provides additional wind energy services, a description of which is available upon request.

2. Summary of Results

Methodology

Our mobile phone analysis was performed using Comsearch's proprietary carrier database, which is derived from a variety of sources including the Federal Communications Commission (FCC). Since mobile phone market boundaries differ from service to service, we disaggregated the carriers' licensed areas down to the county level. Then we compiled a list of all mobile phone carriers in the main counties that intersect the area of interest. The area of interest was defined by the client and encompasses the planned turbine locations. A depiction of the wind project area and counties appears below.

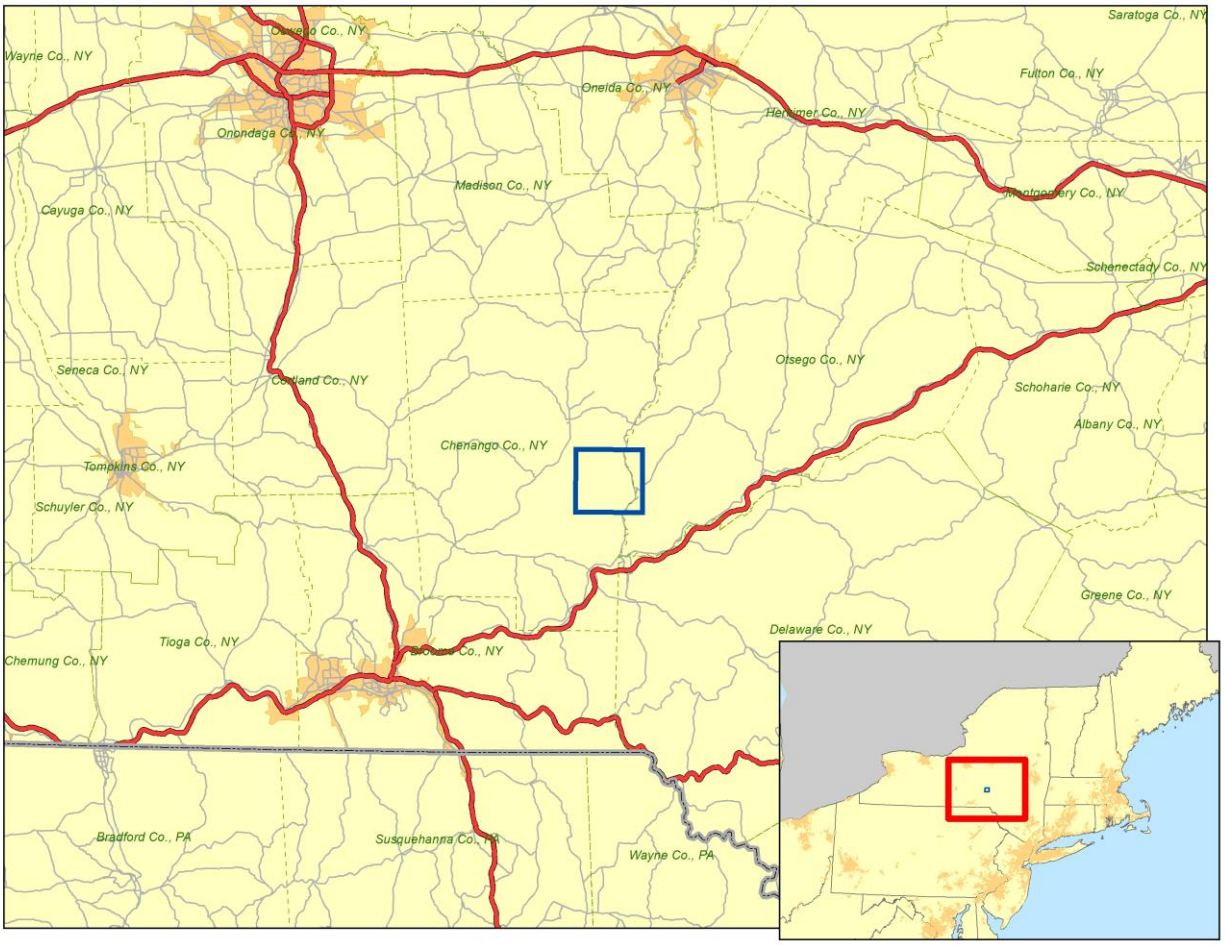

Figure 1: Counties that intersect the Area of Interest

Results
The High Bridge Wind Farm Area of Interest is located in Chenango and Otsego Counties, New York. We have identified the type of service, channel block, market ID and FCC callsign for each carrier in the county of interest. A description of the various service types and geographic market areas is below with a summary table on the following page.

AWS
AWS licensees won their spectrum in an auction that started in August 2006. The licensees are authorized by 734 Cellular Market Areas (CMA) for Block A, 176 Economic Areas (BEA) for Blocks B and C, and 12 Regional Economic Area Groupings (REAG) for Blocks D, E and F. This spectrum at 1.7 and 2.1 GHz was allocated for mobile broadband and advanced wireless services. Partitioning and leases are permitted in the band.

Cellular
Licensees are authorized by Metropolitan and Rural Statistical Areas, also known as CMAs. Unserved areas can be covered by licensees other than the original A or B block licensee. To determine the most realistic coverage, we compiled the Cellular Geographic Service Areas (CGSA) from the 32 dBu contours defined by Part 22.911(a) of the FCC rules. Mobile services are provided at 800 MHz and partitioning and leases are permitted in the band.

PCS
There have been nine auctions for this band, with the last one being held in August 2008. Licensees are authorized by 51 Major Trading Areas (MTA) for Blocks A and B, 493 Basic Trading Areas (BTA) for Blocks C through F, and 176 Economic Areas (EA) for Block G. This band has been heavily partitioned and disaggregated both by counties and by smaller polygons within counties (known as undefined areas or partial counties). The 1.9 GHz PCS carriers provide mobile services and leases are permitted in the band.

700 MHz Band
Originally used for analog television broadcasting, this band consists of an upper and lower band, each having its own set of frequency blocks. There have been three auctions in this band with the last one (Auction 73) being held in 2008 and mobile phone carriers eventually winning licenses for Blocks A, B, and C of the Lower 700 MHz band and Block C of the Upper 700 MHz band. Licensees are authorized by 176 Economic Areas (EA) for Lower Block A, 734 Cellular Market Areas (CMA) for Lower Blocks B and C, and 12 Regional Economic Area Groupings (REAG) for Upper Block C. Partitioning and leases are permitted in the band.

WCS
Mobile services provided in the 2.3 GHz band occupy frequency blocks above and below the spectrum allocated for Satellite Digital Audio Radio Service (SDARS) from 2320 MHz to 2345 MHz. WCS licensees are authorized by 52 Major Economic Areas (MEA) for Blocks A and B and 12 Regional Economic Area Groupings (REAG) for Blocks C and D. Partitioning and leases are permitted in the band.

Service[1]	Mobile Phone Carrier	Channel Block	County	ST	Market ID	Callsign
AWS	Verizon	A	Chenango	NY	CMA562	WQGA833
AWS	AT&T	A	Otsego	NY	CMA563	WQGA834
AWS	Verizon	B	Chenango	NY	BEA006	WQGA903
AWS	T-Mobile	B	Otsego	NY	BEA006	WQPZ975
AWS	AT&T	B	Otsego	NY	BEA006	WQZA668
AWS	AT&T	C	Chenango	NY	BEA006	WQGA864
AWS	T-Mobile	C	Otsego	NY	BEA006	WQZA683
AWS	T-Mobile	D	Chenango and Otsego	NY	REA001	WQGA731
AWS	T-Mobile	E	Chenango	NY	REA001	WQGB373
AWS	Verizon	E	Otsego	NY	REA001	WQPZ962
AWS	T-Mobile	F	Chenango	NY	REA001	WQPZ969
AWS	Verizon	F	Otsego	NY	REA001	WQGA715
Cellular	AT&T	A	Chenango and Otsego	NY	CMA562	KNKN827
Cellular	AT&T	A	Chenango and Otsego	NY	CMA563	KNKN633
Cellular	Verizon	B	Chenango and Otsego	NY	CMA562	KNKQ423
Cellular	Verizon	B	Chenango and Otsego	NY	CMA563	KNKN999
PCS	T-Mobile	A	Chenango	NY	MTA001	KNLF202
PCS	AT&T	A	Otsego	NY	MTA001	WQEY218
PCS	AT&T	A	Chenango and Otsego	NY	MTA001	WPSL626
PCS	AT&T	A	Chenango and Otsego	NY	MTA001	WRAB209
PCS	Sprint	B	Chenango and Otsego	NY	MTA001	KNLF204
PCS	Verizon	C	Chenango	NY	BTA043	WPTB337
PCS	Blue Wireless	C	Chenango	NY	BTA043	WQCS395
PCS	Verizon	C	Otsego	NY	BTA333	WPTB357
PCS	T-Mobile	D	Chenango	NY	BTA043	KNLG387
PCS	T-Mobile	D	Otsego	NY	BTA333	KNLG507
PCS	AT&T	E	Chenango	NY	BTA043	KNLG388

[1] AWS: Advanced Wireless Service at 1.7/2.1 GHz
CELL: Cellular Service at 800 MHz
PCS: Personal Communication Service at 1.9 GHz
700 MHz: Commercial Mobile Phone at 700 MHz
WCS: Wireless Communication Service at 2.3 GHz

Service[1]	Mobile Phone Carrier	Channel Block	County	ST	Market ID	Callsign
PCS	AT&T	E	Otsego	NY	BTA333	KNLG508
PCS	Verizon	F	Chenango	NY	BTA043	KNLH240
PCS	Delaware PCS Limited Partnership	F	Otsego	NY	BTA333	KNLF910
PCS	Sprint	G	Chenango and Otsego	NY	BEA006	WQKS996
700 MHz	T-Mobile	Lower A	Chenango and Otsego	NY	BEA006	WQIZ389
700 MHz	AT&T	Lower B	Chenango	NY	CMA562	WQJU616
700 MHz	AT&T	Lower B	Otsego	NY	CMA563	WQIZ420
700 MHz	AT&T	Lower C	Chenango	NY	CMA562	WPYZ979
700 MHz	AT&T	Lower C	Otsego	NY	CMA563	WPWV408
700 MHz	AT&T	Lower D	Chenango and Otsego	NY	EAG701	WPZA235
700 MHz	DISH Network	Lower E	Chenango and Otsego	NY	BEA006	WQJY948
700 MHz	Verizon	Upper C	Chenango and Otsego	NY	REA001	WQJQ689
WCS	AT&T	A	Chenango and Otsego	NY	MEA002	KNLB312
WCS	AT&T	B	Chenango and Otsego	NY	MEA002	KNLB204
WCS	AT&T	C	Chenango and Otsego	NY	REA001	WPQL636
WCS	AT&T	D	Chenango and Otsego	NY	REA001	KNLB297

Table 1: Mobile Phone Carriers in the Area of Interest

FCC-Licensed Sites

For competitive and confidentiality reasons, most mobile phone carriers' individual sites are not licensed with the FCC. However, in the cellular band, if a base station extends the existing Cellular Geographic Service Area (CGSA), then it must be recorded with the FCC. We identified two cellular sites within 2 miles of the High Bridge Project Area. Figure 2 on the next page depicts their locations in relation to the area of interest and Table 2 contains the technical parameters on the FCC licenses.

Callsign	Licensee	Structure Height to Tip (m)	ASR Number	Location Address	Latitude (NAD83)	Longitude (NAD83)
KNKN827	AT&T	118.3	1004180	183 North Pond Rd	42.435667	-75.512639
KNKQ423	Verizon	56.4		Norwich Cell Site 1591 County Rd 36	42.503000	-75.500556

Table 2: FCC-Licensed Mobile Phone Sites

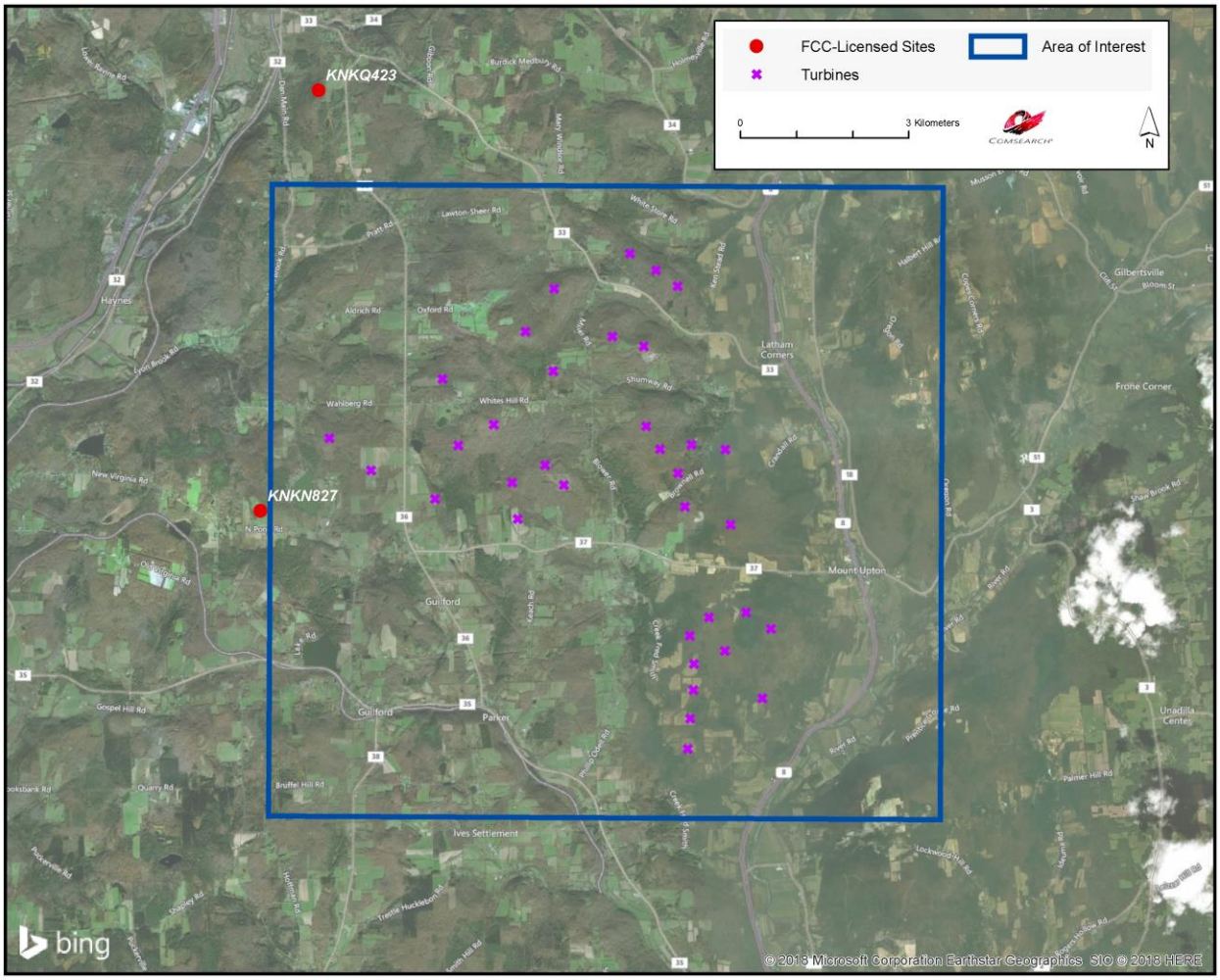

Figure 2: FCC-Licensed Mobile Phone Sites Within Two Miles of the Area of Interest

Impact Assessment and Distance Setback Requirements

The cellular mobile phone signal propagation is typically not affected by physical structures because the beam widths of the radiated signal from the base stations and mobile units are very wide and the wavelength of the signal is long enough to wrap around objects such as wind turbine towers and blades. In addition, the cellular network consists of multiple base stations that are designed so that if the connection cannot be made to one base station it will shift to adjacent base stations to make the connection. This enables cellular mobile telephone systems to provide coverage in areas that are congested with physical structures such as downtown urban areas. Areas containing wind turbines have less of a coverage issue than urban areas, so the wind turbines presence does not require any special setback for signal obstruction consideration other than physical clearance of the blades. From an electromagnetic interference standpoint, the emissions from the wind turbines, which are specified by the FCC, should be taken into account to ensure they will not interfere with the base stations or the mobile units. Part 15 of the FCC regulations covers the emissions from unintentional radiating devices, such as wind turbines. The field strength limits for the emissions from unintentional radiators is given in paragraph 15.109 of Part 15 of the FCC rules. The emission limits are stated for a distance of 3 meters or approximately 10 feet and are shown below.

Radiated Emission Limits at 3 Meters

Frequency of Emission (MHz)	Field Strength (microVolts/meter)
30 – 88	100
88 – 216	150
216 – 960	200
> 960	500

From these limits and the receiver sensitivity of the cellular base stations and mobile units we can determine a setback requirement for wind turbines and cellular system. The typical sensitivity of mobile units is -90 dBm ($1X10^{-12}$ Watts) and the typical sensitivity of base stations is -93 dBm ($5X10^{-13}$ Watts). The gain of mobile unit antennas are -10dB or 0.1 and the gain of base station antennas are 17 dB or 50. The effective area (A) of the mobile unit and base station antennas are determined from the following formula.

$$A = G*\lambda^2 / 4*\pi$$

Where,
G = Antenna Gain, number
λ = Wavelength, 0.353 meters
π = 3.14

This gives us an effective area for the mobile unit antenna of $9.9X10^{-4}$ meter^2 and the effective area for the base station antenna of 0.496 meter^2. Using the typical receiver sensitivities of the mobile and base units above, we can determine their power flux density (P_D) from the following formula:

$$P_D = S/A$$

Where S is defined as the sensitivity for Mobile Unit or for the Base Station expressed in Watts

To calculate the electric field strength (E) we use the following formula:

$$E = (P_D * 377)^{½}$$

So for the mobile unit, $P_D = 1.01X10^{-9}$ Watts/meter^2 and E = 617 microVolts/meter. And, for the base station unit, $P_D = 1.008X10^{-12}$ Watts/meter^2 and E= 19.4 microVolts/meter.

These results show that the mobile units' sensitivity expressed as field strength is above the level allowed as an emission for the wind turbines at a distance of 3 meters. Therefore, no setback for the use of a mobile unit is needed beyond 3 meters. Since the base station has field strength sensitivity below the allowed emission level of the wind turbines a setback distance is needed to ensure that the base stations will not be affected. The field strength of the emission is inversely proportional to separation distance in meters. To determine the setback distance to reduce the field strength to 19.4 microVolts/meter the following formula is used.

D = (500 MicroVolts/meter)*(3 meters) / 19.4 MicroVolts/meter

Where,
D = Setback Distance for Base Station to avoid interference, meters

Thus the setback distance for the cellular tower base station from the wind turbines should be 77.3 meters or greater.

Summary
The telephone communications in the mobile phone carrier bands are typically unaffected by the presence of the wind turbines and we do not anticipate any significant harmful effect to mobile phone services in High Bridge Project Area. Mobile phone systems are designed with multiple base transmitter stations covering a specific area. Since mobile telephone signals are designed with overlap between adjacent base transmitter sites in order to provide handoff between cells, any signal blockage caused by the wind turbines does not materially degrade the reception because the end user may be receiving from multiple transmitter locations. For example, if a particular turbine attenuates the signal reception into a mobile phone, the phone may receive an alternate signal from a different transmit location, resulting in no disruption in service. Mobile phone systems that are implemented in urban areas near large structures and buildings often have to combat even more problematic signal attenuation and reflection conditions than rural areas containing a wind energy turbine facility.

For the cellular towers located near the project area, no setback distance is required from an interference standpoint other than physical clearance of the blades. From an electromagnetic

standpoint, a setback distance of 77.3 meters should be used to meet FCC emission requirements.

In the unlikely event that a mobile phone carrier believes their coverage has been compromised by the presence of the wind energy facility, they have many options to improve their signal coverage to the area through optimization of a nearby base transmitter or even adding a new sector or cell site. Utility towers, meteorological towers or even the turbine towers within the wind project area can serve as the platform for a base transmit site or cell enhancer.

3. Contact Us

For questions or information regarding the Mobile Phone Carrier Report, please contact:

Contact person:	David Meyer
Title:	Senior Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5656
Fax:	703-726-5595
Email:	dmeyer@comsearch.com
Web site:	www.comsearch.com