

Wind Power GeoPlanner™

Microwave Study

TB Flats



Prepared on Behalf of
Invenergy LLC

April 20, 2017



COMSEARCH
A CommScope Company

Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Fresnel Zone Analysis	- 2 -
4. Conclusion	- 5 -
5. Contact	- 5 -

1. Introduction

Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. This report focuses on the potential impact of wind turbines on licensed, proposed and applied non-federal government microwave systems.

2. Project Overview

Project Information

Name: TB Flats

County: Carbon and Albany

State: Wyoming

Number of Turbines: TBD

Blade Diameter: 116 meters

Hub Height: 90 meters

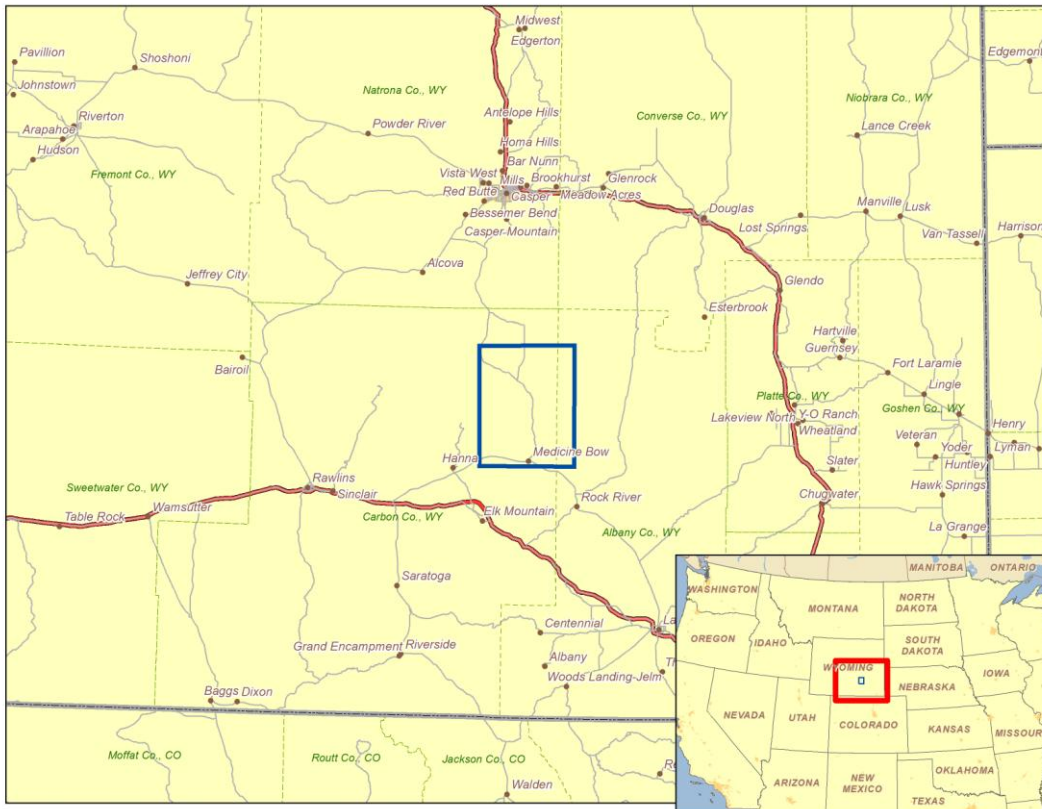


Figure 1: Area of Interest

3. Fresnel Zone Analysis

Methodology

Our obstruction analysis was performed using Comsearch’s proprietary microwave database, which contains all non-government licensed, proposed and applied paths from 0.9 - 23 GHz¹. First, we determined all microwave paths that intersect the area of interest² and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

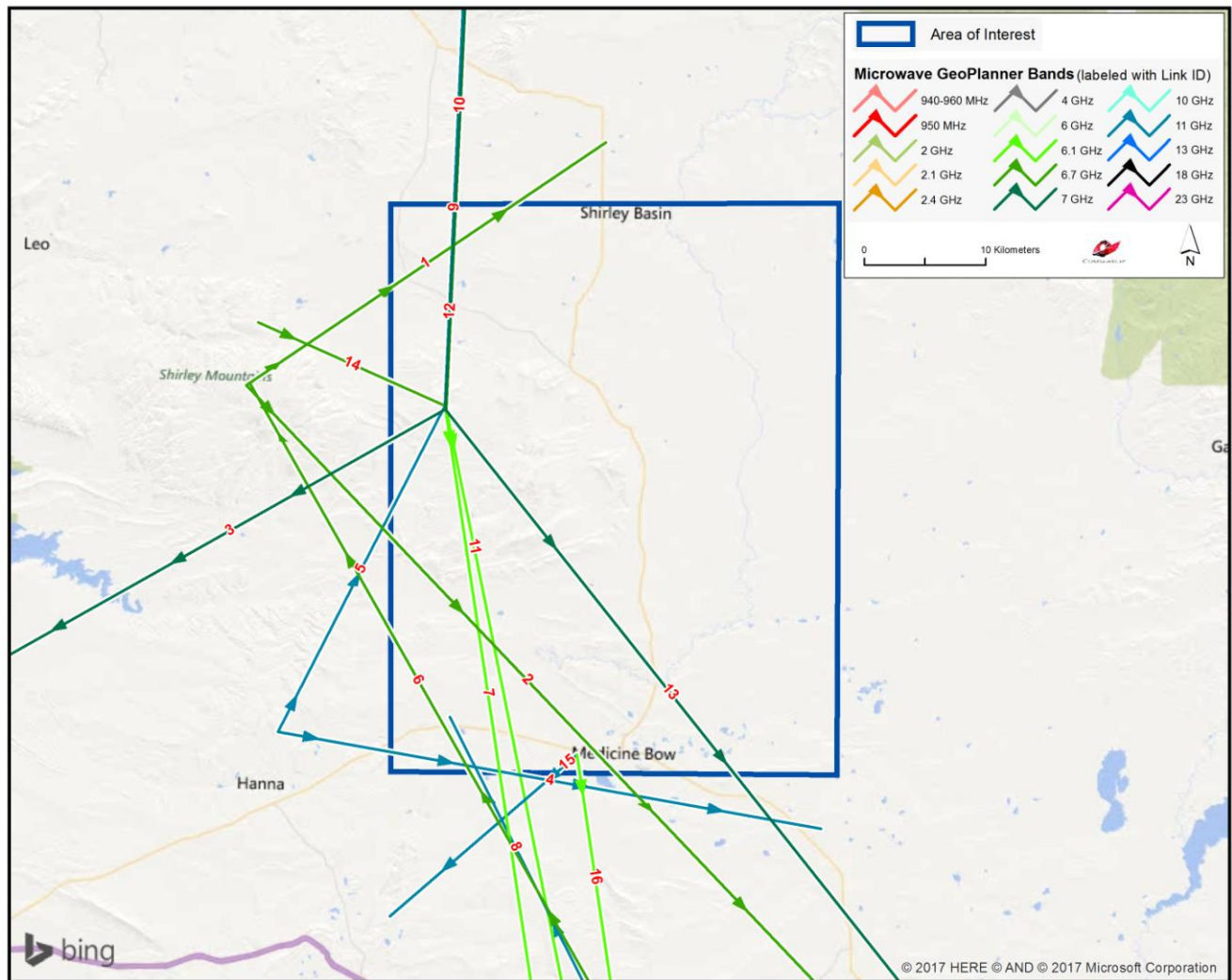


Figure 2: Microwave Paths that Intersect the Area of Interest

¹ Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

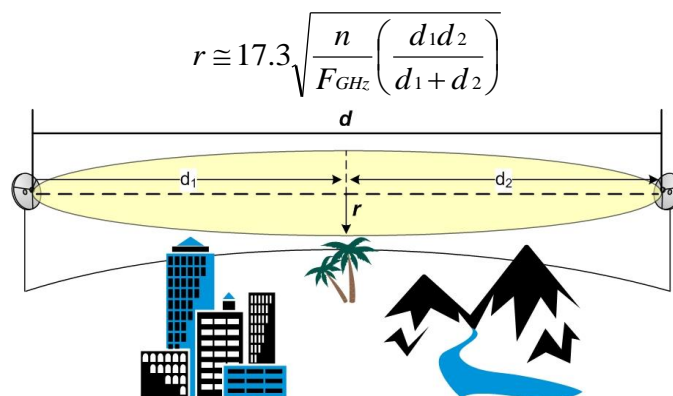
² We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Licensed	WGX806	WGX805	Upper 6 GHz	35.71	Tri-State Generation & Transmission Assn
2	Questionable	WGX806	WGX808	Upper 6 GHz	135.82	Tri-State Generation & Transmission Assn
3	Licensed	WLF678	RXONLY	7 GHz	82.47	Wyomedia Corporation
4	Licensed	WMV941	WAY80	11 GHz	45.42	Union Telephone Company, Inc.
5	Licensed	WMV941	WPNG892	11 GHz	30.22	Union Telephone Company, Inc.
6	Licensed	WNEN335	WHI693	Upper 6 GHz	87.19	State of Wyoming, Dept of Transportation
7	Proposed	WPNG892	WAGONHOU	Lower 6 GHz	58.50	Union Telephone Company, Inc.
8	Licensed	WPOP232	WQKF285	11 GHz	33.53	PacifiCorp
9	Licensed	WQAE282	WPNG892	11 GHz	65.36	Union Telephone Company, Inc.
10	Licensed	WQDJ682	WQDJ684	Upper 6 GHz	65.72	Central Wyoming College
11	Licensed	WQDJ684	WQDG857	Lower 6 GHz	65.40	Central Wyoming College
12	Licensed	WQGH707	RXONLY	7 GHz	65.76	Wyomedia Corporation
13	Licensed	WQGH710	RXONLY	7 GHz	125.90	Wyomedia Corporation
14	Licensed	WQQY675	WPNG892	Upper 6 GHz	16.84	Union Telephone Company, Inc.
15	Licensed	WQRA313	WQFV976	11 GHz	20.38	Verizon Wireless
16	Licensed	WQRA313	WQKR618	Lower 6 GHz	36.07	Verizon Wireless

Table 1: Summary of Microwave Paths that Intersect the Area of Interest

(See enclosed *mw_geopl.xlsx* for more information and
GP_dict_matrix_description.xls for detailed field descriptions)

Next, we calculated a Fresnel Zone for each path based on the following formula:



Where,

- r = Fresnel Zone radius at a specific point in the microwave path, meters
- n = Fresnel Zone number, 1
- F_{GHz} = Frequency of microwave system, GHz
- d_1 = Distance from antenna 1 to a specific point in the microwave path, kilometers
- d_2 = Distance from antenna 2 to a specific point in the microwave path, kilometers

The calculated Fresnel Zone shows the narrow area of signal swath and is calculated for each microwave path in the project area. In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the individual Fresnel Zones is shown in Figure 3, and is also included in the shapefiles^{3,4}.

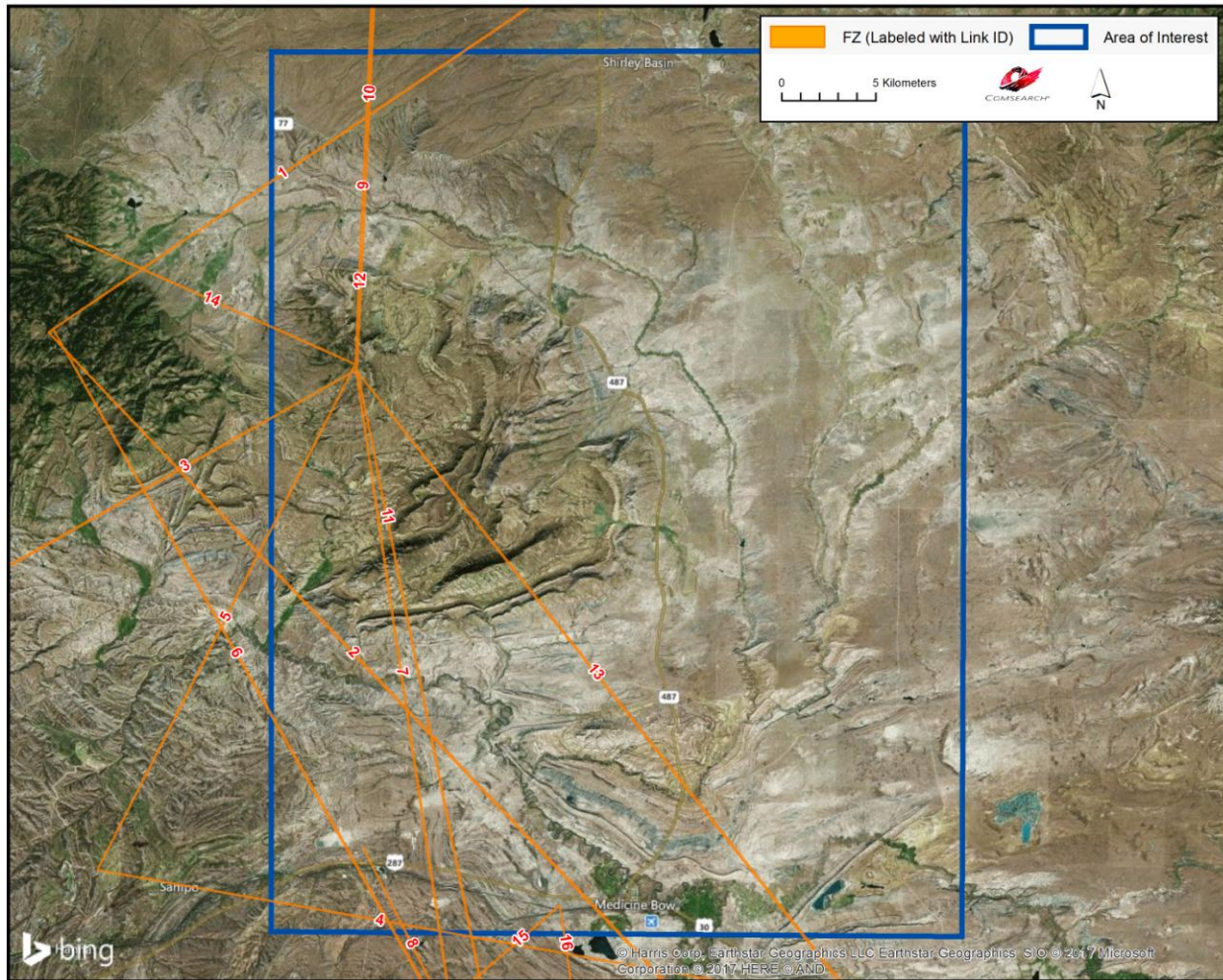


Figure 3: Fresnel Zones in the Area of Interest

³ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 13 projected coordinate system.

⁴ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

Discussion of Potential Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting Fresnel Zones
16	N/A	N/A	N/A

For this project, turbine locations were not provided; thus we could not determine if any potential obstructions exist between the planned wind turbines and the incumbent microwave paths. If the latitude and longitude values for turbine locations are provided, Comsearch can identify where a potential conflict might exist.

4. Conclusion

Our study identified 16 microwave paths intersecting the TB Flats project area. The Fresnel Zones for these microwave paths were calculated and mapped. We recommend that all turbines be sited in locations that will not obstruct the Fresnel Zones.

5. Contact

For questions or information regarding the Microwave Study, please contact:

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