Appendix N

Communication Interference and Microwave Path Analyses

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C. Childress, 2026. *GBTL Segment 2 Transmission Line Project, Microwave Path Analysis*. Capitol Airspace Group, October 16, 2026

LRTP 26 765 kV Route - Gopher to Badger Transmission Link Segment 1

Xcel Energy

Minnesota

Communication Systems (AM/FM Radio, TV, LMR, and Communications Towers) Interference Analysis

August 14, 2026

Capitol Airspace Group

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Introduction

Capitol Airspace conducted a communication systems interference analysis for the LRTP 26 765 kV Route - Gopher to Badger Transmission Link (GBTL) Segment 1 project in Minnesota. At the time of this analysis, a 62.8 kilometer (39 mile) transmission line segment (magenta line, ***Figure 1***) was identified for analysis. The full potential width (black line, ***Figure 1***) was studied as the project boundary. The purpose of this analysis was to identify Amplitude Modulation (AM) and Frequency Modulation (FM) Radio, Television (TV), Land Mobile Radio (LMR) systems, and communications towers potentially carrying E911 service which may be impacted by this project.

AM and FM radio, along with TV stations, are a critical component of the national communications infrastructure. These stations broadcast emergency, news, music, entertainment, and educational content. LMR systems play a critical role in enabling seamless communication among public safety agencies, emergency responders, and transportation services, ensuring swift and coordinated responses to urgent situations and enhancing overall public safety nationwide. Proposed structures that interfere with these systems can degrade the services that they provide.

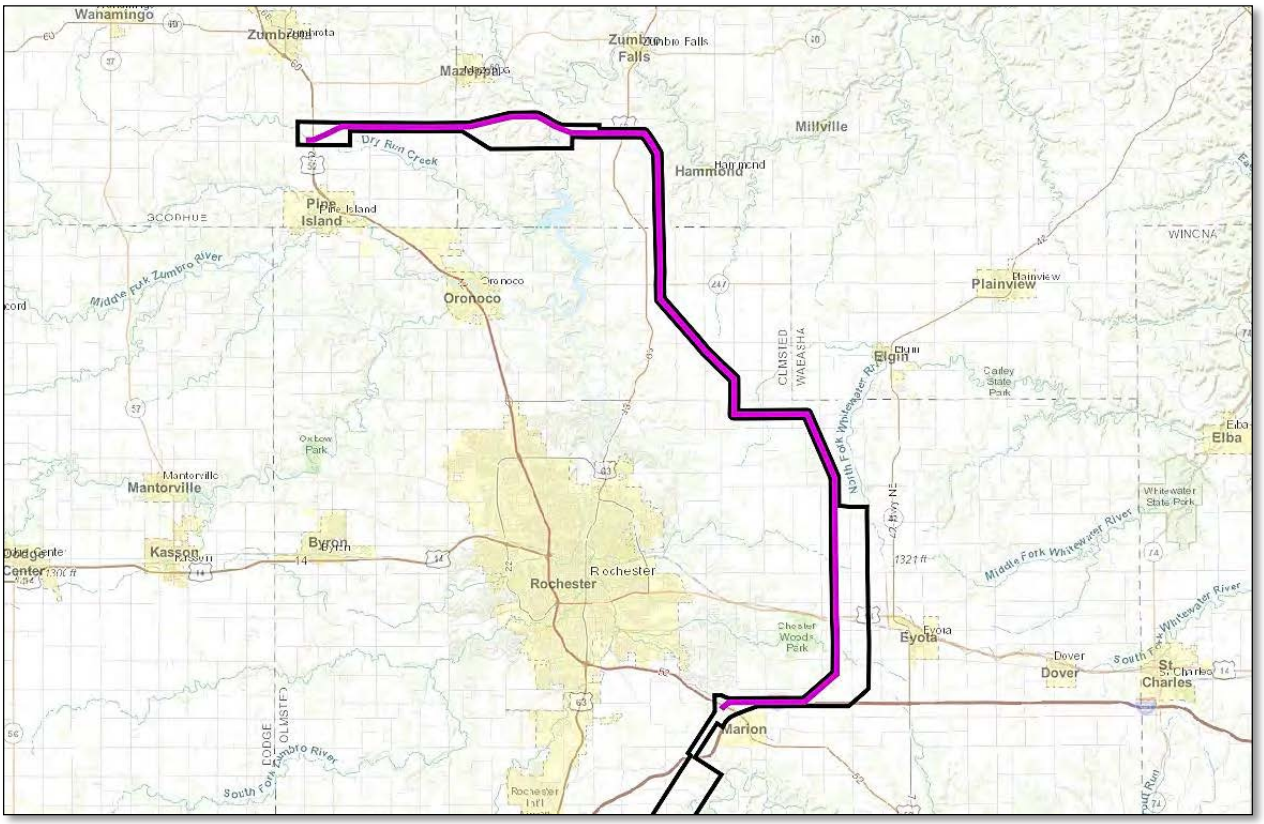


Figure 1: LRTP 26 765 kV Route - Gopher to Badger Transmission Link Segment 1

Transmission lines have the potential to disrupt communication systems by physical obstruction of the antenna pattern as well as interference at the receiver. The likelihood of disruption depends on the characteristics of the radio frequency (RF) signal and the proximity of transmission lines to communication system components. Therefore, the proximity of a transmission line to a communication facility plays a crucial role in predicting potential interference. This analysis focuses on understanding how the placement of transmission lines relates to the probability of interference.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. Using this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to communication facilities contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS), Licensing and Management System (LMS), and Antenna Structure Registration (ASR) databases. Additional non-FCC tower databases were also used to determine locations of un-registered towers.

This analysis considers the potential impact of the proposed transmission line project on communication system transmission facilities based on RF signal propagation characteristics, and on RF reception based on Electromagnetic Interference (EMI, or "RF Noise") from the transmission line segments.

AM Radio

Proposed structures located within a certain distance of an AM radio station's transmitter site can have an impact on the station's licensed coverage pattern. The triggering distance for consideration, notification, and possible remedial actions is based on guidance provided by the FCC via 47 CFR §1.30002. If transmission lines are placed within that distance, Xcel Energy should notify the radio station and may have to remediate any issues that arise by that placement. Remediation is relatively simple when done by qualified RF consultants. Properly installed and maintained 765 kV transmission lines of this height should not cause electrical noise to AM reception outside a distance of 100 meters (328 feet).

FM Radio and TV

The location of a proposed structure within an RF signal's propagation regions can determine the potential for impact (***Figure 2***). Within the near field, RF signals behave unpredictably and are more susceptible to distortion from obstacles. In the far field, radio waves are more parallel and uniform and have spread over a larger area. Obstacles in the far field are less likely to have an impact on RF signals. The distance to the end of the near field is called the "Fraunhofer distance". [1]

[1] The Fraunhofer Distance (d_f) is calculated as follows: $d_f = 2D^2/\lambda$, where D is the dimension of the antenna aperture and λ is the wavelength of the signal.

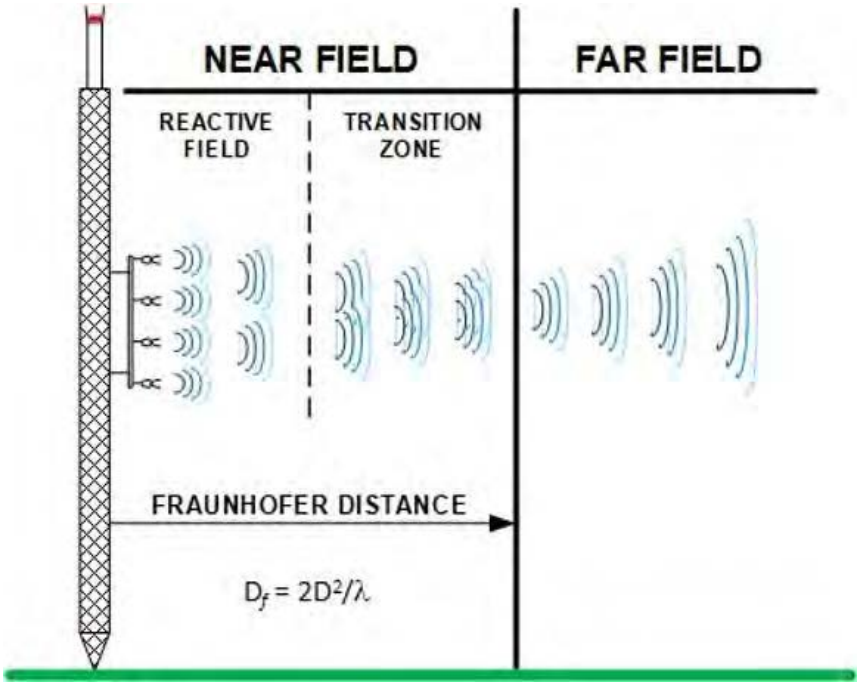


Figure 2: RF signal transition from the near-field to the far-field of a transmitter

LMR and Cellular

Proposed structures like transmission lines also affect LMR and cellular transmission and reception in the same way that they affect FM and TV stations, as the frequencies are similar. The LMR and cellular antennas are evaluated for a worst-case distance from the transmission line so that they are not affected by any physical obstruction of the proposed transmission line.

In many cases, ULS and LMS antenna locations as well as antenna structure registration (ASR) tower locations are inaccurate. When a communication system transmitter's location was critical, available satellite and aerial imagery were used to improve its coordinates. Available imagery was also used to identify potential receivers in proximity to the project boundary.

Findings

AM Radio

AM Radio Transmission

Large metal structures located within ten wavelengths of an AM radio station transmitter site have the potential to adversely affect AM transmission. FCC Rule Section 1.30002 details the notification process that should be undertaken when transmission lines are built near an AM station. This FCC Rule addresses the addition of large structures which can cause the AM station facility to be out of compliance with their FCC license depending on their height and proximity to the AM station. There are no AM stations within the project boundary. KFAN(AM) is the closest AM station to the project. It is a directional AM station at 1270 kHz, 6.9 km west of both segment 1 and segment 2. To satisfy FCC Rule Section 1.30002(b), transmission lines should be sited at least ten wavelengths from a directional AM station. In the case of KFAN(AM), the ten-wavelength distance is 2361 meters (***Table 1*** and light purple circle in ***Figure 3***). Since this 2361-meter notification distance does not intersect the project buffer, there should be no impact to this or any other AM station, and the station does not have to be notified of construction.

AM Radio Reception

Even a properly installed and maintained transmission line[2] has the ability to cause noise through electrical field and magnetic field "coupling" which affects AM receivers. The setback distance from the transmission line to a potential AM receiver is based on the transmission line support structure height which is twice the height of the tallest transmission line tower. The tallest support structure in the project is assumed to be no taller than 200 feet for this analysis, so the setback distance to avoid AM receiver interference in houses and buildings would be 400 feet, or roughly 122 meters. When examining aerial imagery, there appears to be no place where any of the transmission line segments are closer than 122 meters to any habitable buildings where AM receivers might exist. Vehicles traveling on roadways past or under the transmission lines may experience temporary AM reception "buzz", which will dissipate quickly.

Table 1: AM radio transmitters in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1

Licensee	Call Sign	Frequency (kHz)	Antenna	Notification Distance (km)	Distance to Nearest T-Line (km)	Coordinates
IHM Licenses, LLC	KFAN(AM)	1270	Directional	2.36	6.9	43 58 46.90 N, 92 26 51.60 W

[2] Proper installation includes grounding and bonding, and corona suppression mechanisms. Proper maintenance includes checking, repairing and replacing such items periodically.

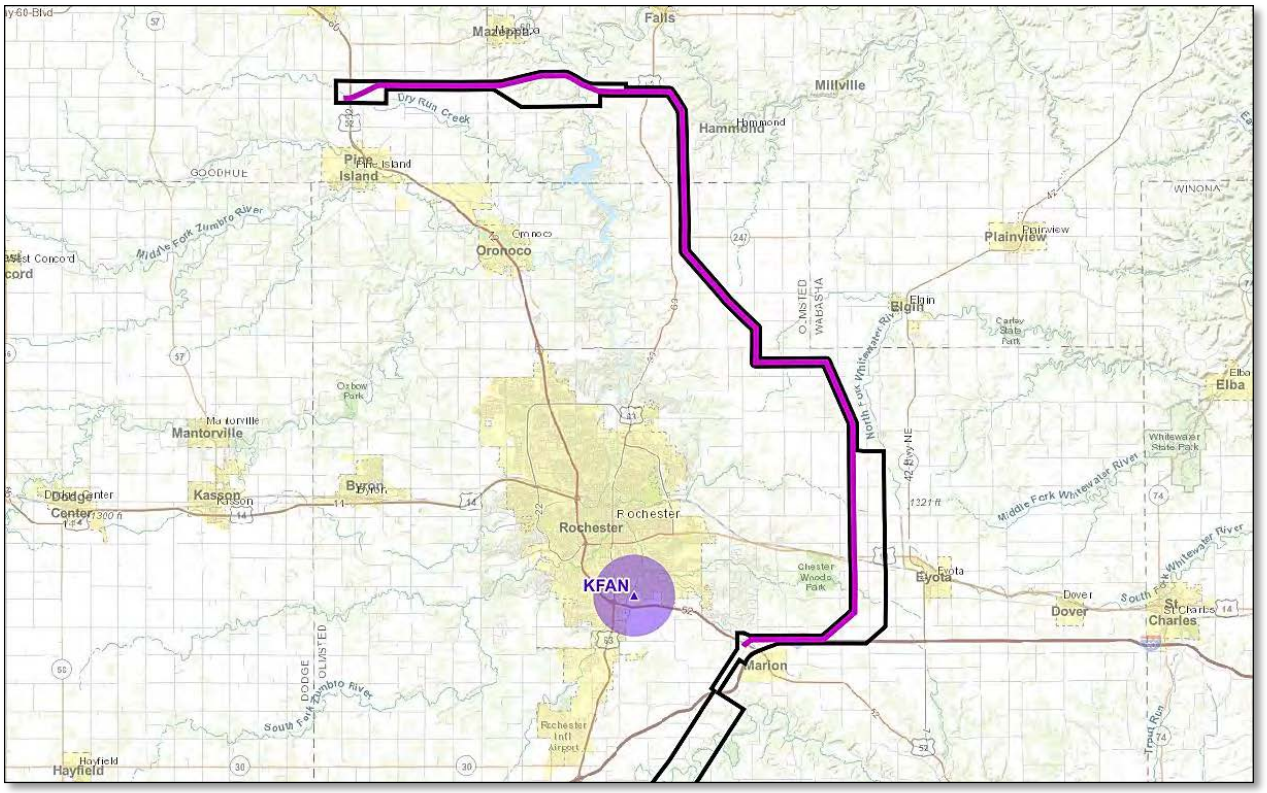


Figure 3: AM radio transmitter (purple triangle) and notification distance (light purple circle) in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1

FM Radio

FM Radio Transmission

The effects of the proposed project on FM radio transmission are predominantly physical in nature. The concern is that tall structures built within an FM transmitting antenna's near field (see ***Figure 2***) will distort the transmitted signal. There are no FM transmitter facilities located within the transmission line project area. The closest FM stations to segment 1 is a group of six FM stations located on two side-by-side towers located 3.9 km west of segment 1 of the transmission line. From the near field distance discussion in ***Figure 2***, the far field distances of the FM stations are shown in ***Table 2*** and the worst case far field distance is shown as the light green circle in ***Figure 4***. Since the antenna far field distance is far less than the distance to the proposed transmission line, there should be no adverse effect on this, or any other nearby FM radio station transmissions.

FM Radio Reception

Unless the transmission lines are sited within 50 meters (165 feet) of a potential receiver (houses, businesses and roads), it is unlikely that the transmission lines will have a perceivable EMI impact on FM radio reception. Study of aerial imagery indicates that there are no potential houses or buildings within this distance of transmission line segment 1. Vehicles traveling on roads in proximity to the transmission line project should experience only fleeting interruption in signal, if at all.

Table 2: FM radio transmitters in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1

Licensee	Call Sign	Status	Frequency (MHz)	Distance to T-Line (km)	Near Field Radius (m)	Corrected Coordinates
University of Northwestern-St. Paul	K232EK	License	94.3	3.9	<10	44 02 31.90 N, 92 20 25.00 W
Rochester Public Radio	KRPR(FM)	License	89.9	3.9	36	44 02 28.20 N, 92 20 25.50 W
Minnesota Public Radio	KMSE-FM	License	88.7	3.9	75	44 02 28.20 N, 92 20 25.50 W
Blooming Prairie Farm Radio Inc.	KNXR(FM)	License	97.5	3.9	334	44 02 28.20 N, 92 20 25.50 W
Minnesota Public Radio	KZSE-FM	License	91.7	3.9	571	44 02 28.20 N, 92 20 25.50 W
Minnesota Public Radio	KLSE-FM	License	90.7	3.9	577	44 02 28.20 N, 92 20 25.50 W

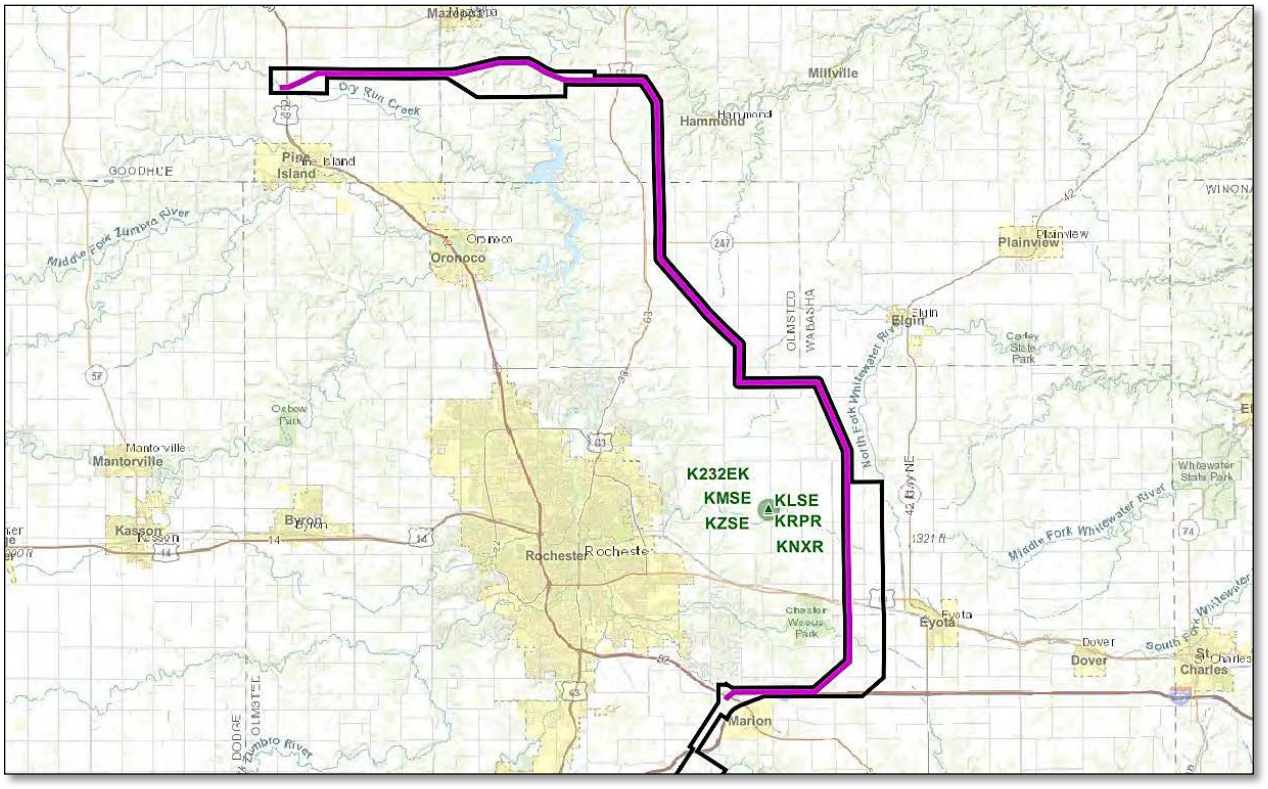


Figure 4: FM radio transmitters (green triangles) and worst case FM far field distance (light green circle) in proximity to LRTP 26 765 kV Route - Gopher to Badger Transmission Link segment 1

Television (TV)

TV Transmission

Similar to FM radio, which is also a "line of sight" service, the effects of the proposed project on TV transmission are predominantly physical in nature. The concern is that tall structures built within the TV transmitting antenna's near field (see ***Figure 2***) will distort the transmitted signal. There are no TV transmitter facilities located within the transmission line project area (***Table 3*** and ***Figure 5***). Low power TV station K25NK-D is 3.9 km west of the project. From the near field distance discussion in ***Figure 2***, the far-field distance of the K25NK-D antenna is 73 meters. Since the antenna far field distance is far less than the distance to the transmission line segment, there should be no adverse effect on this, or any other nearby TV station transmissions. The far field distance is too small to resolve on the map in ***Figure 5***.

TV Reception

Unless the transmission lines are installed within 50 meters (165 feet) of a potential TV receiver (houses or businesses), it is unlikely that the transmission lines will have a perceivable EMI impact on television reception. Study of aerial imagery indicates that there are no potential houses or buildings within this distance of any of the transmission line segments.

Table 3: TV transmitter in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1

Licensee	Call Sign	Status	Corrected Coordinates	Near Field Radius (m)	Distance to T-Line (km)
Three Angels Broadcasting Network, Inc.	K25NK-D	License	44 02 28.20 N, 92 20 25.50 W	73	3.9

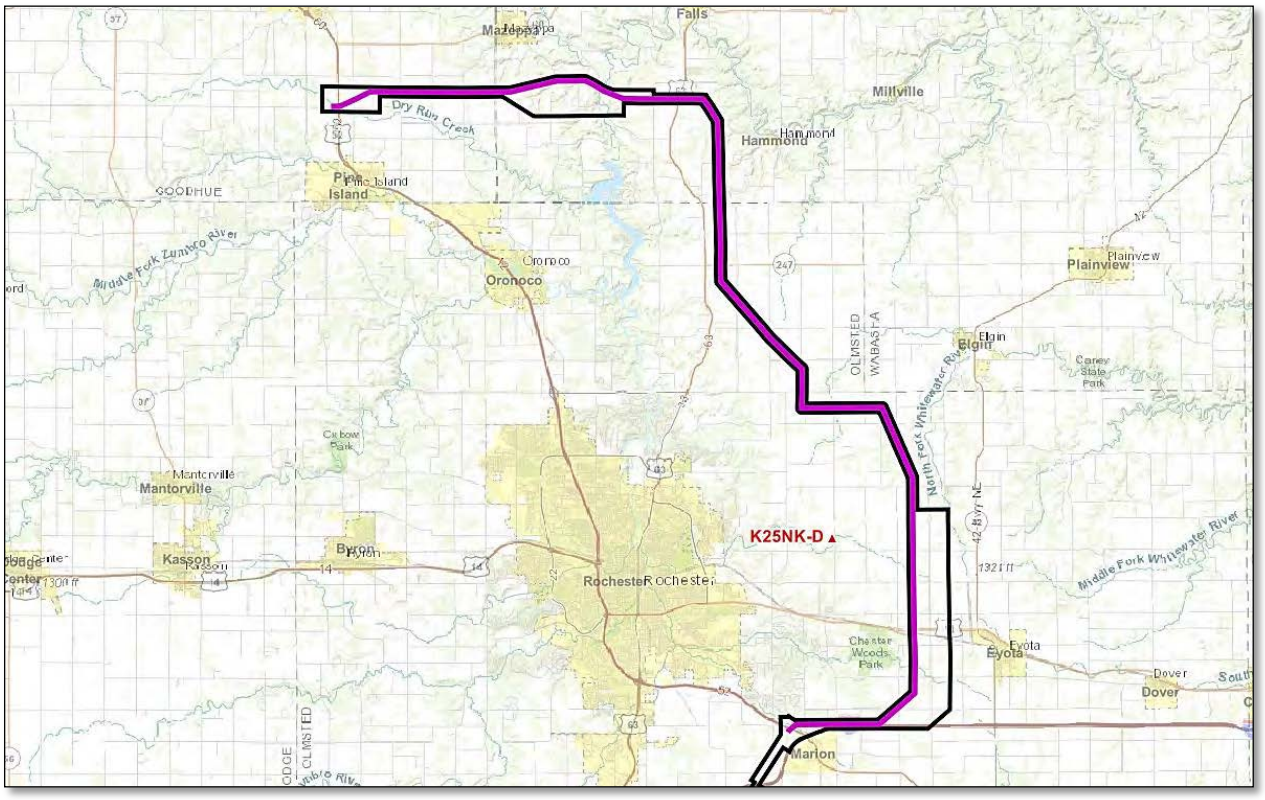


Figure 5: TV transmitter (red triangle) in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1

Land Mobile Radio (LMR)

LMR Base Station (Fixed Site) Transmission and Reception

Land mobile radio systems operate at both VHF and UHF, and LMR radios are typically both transmitters and receivers. Unless the transmission lines are sited within 50 meters (165 feet) of a VHF LMR base station radio (houses or businesses), or within 30 meters of a UHF LMR base station, it is unlikely that the transmission lines will have a perceivable EMI impact on transmission or reception. Study of aerial imagery indicates that there are no houses or buildings within this distance of any of the transmission line segments. There are two licensed LMR base stations within the transmission line project area (***Table 4*** and ***Figure 6***). However, neither of them is within 50 meters of the transmission line, so there should be no impact to LMR base station transmission.

LMR Mobile Transmission and Reception

The signal from a mobile LMR radio is generally broad and can scatter around intervening physical objects like transmission lines, and typical LMR systems employ redundant systems such as multiple transceivers in their design as a means of ensuring service in a region, so there should be little impact to LMR mobile reception. Since mobile radios are frequently in motion, users of handheld radios often adjust their positions to address any interference. There should be no impact from the transmission line project to land mobile radio licenses.

Table 4: LMR base stations within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1 project area

Licensee	Call Sign	Location	Status	Frequency (MHz)	Distance to T-Line Segment (m/ ft)	Corrected Coordinates
Michel Farming LLC	KNBG738	1	License	461.5250	297/975	44 10 01.90 N, 92 24 47.60 W
Hilltop Communications, Inc	WQRB561	1	License	462.0625/ 463.2000	845/2,772	44 01 20.55 N, 92 16 43.70 W

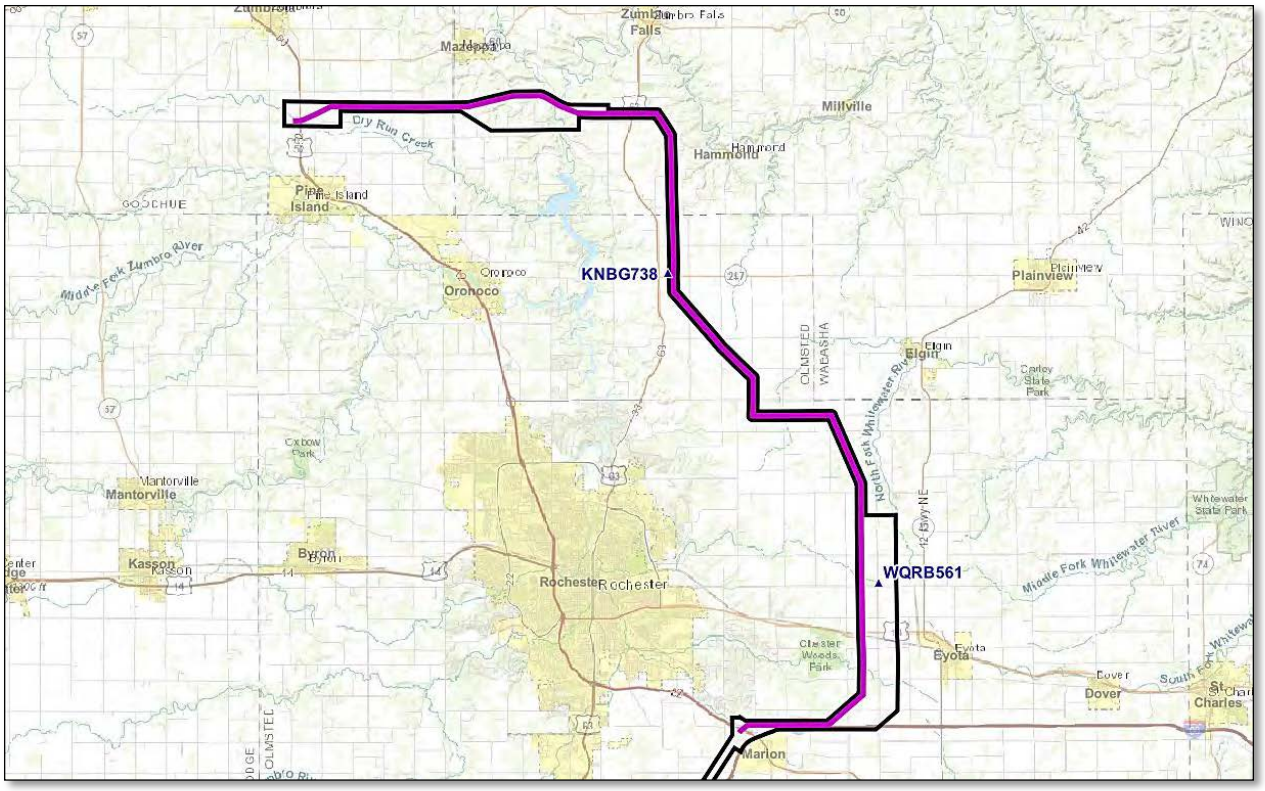


Figure 6: LMR Licenses (dark blue triangles) within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1 project area

Other Communications Towers – Cellular Service and E911 Signaling

The primary concern with antenna towers not identified in the sections above is the potential for interference to cellular service. Similar to LMR radios, cellular radio systems on towers both transmit and receive. There are four known communications towers or cellular licenses within the proposed transmission line project area (*Table 5* and *Figure 7*). However, unless the transmission lines are sited within 30 meters (98 feet) of a tower with a cellular radio, there should be no impact from the transmission line to either cellular transmission or reception. In fact, there are many cases in the U.S. where there is cellular service mounted on towers either directly next to or on high-power transmission line towers; There should be no impact to any cellular service or E911 signaling from the transmission line project.

Table 5: Communications towers within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1 project area

FCC ASRN	Tower Owner	Height Above Ground (m)	Distance to Nearest T-Line (m/ft)	Corrected Coordinates
1216194	CCTM2 LLC	59.4	240/787	43 57 30.40 N, 92 20 22.80 W
1251621	American Towers LLC	79.2	326/1,070	44 14 20.05 N, 92 26 52.85 W
1023351	CCATT LLC	75.3	755/2,477	44 14 58.25 N, 92 38 29.10 W
1045800	Hansel, Alan M dba SMC	85.0	845/2,772	44 01 20.55 N, 92 16 43.70 W

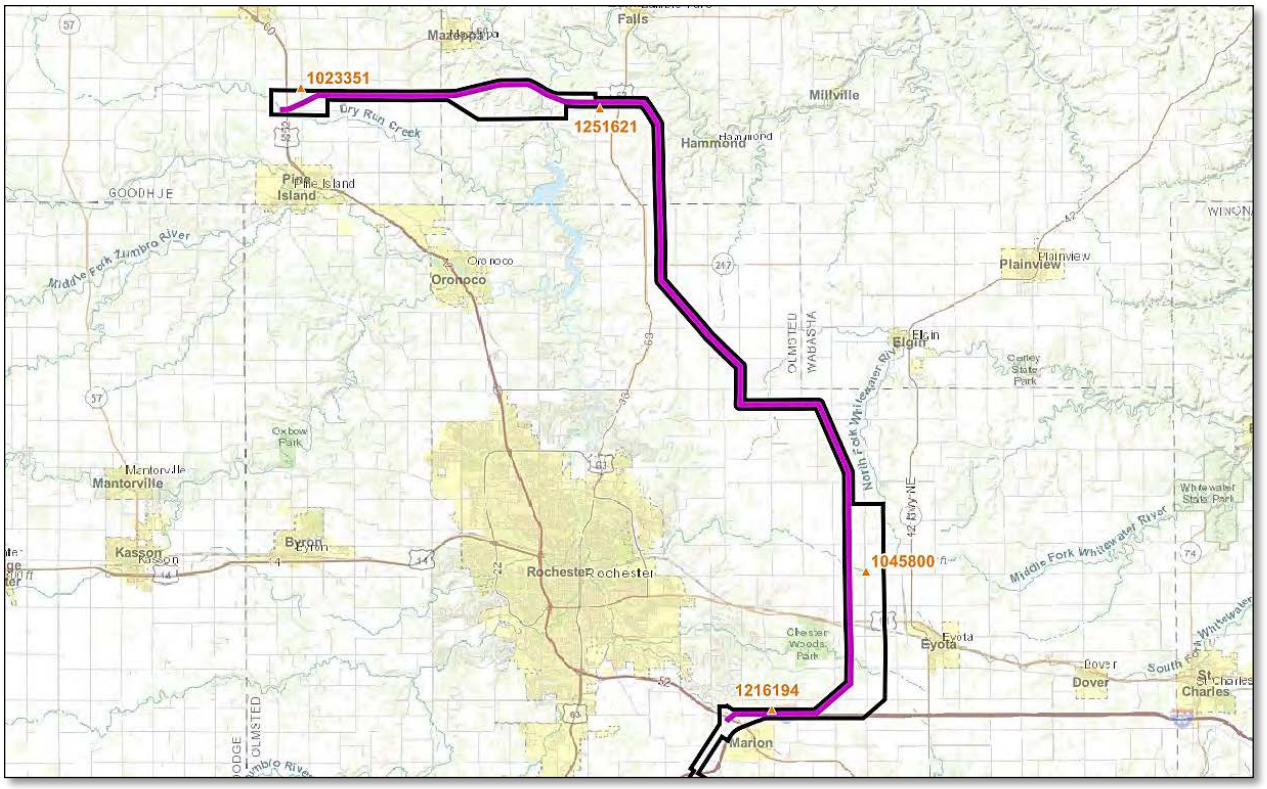


Figure 7: Towers (orange triangles) within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 1 project area

Conclusion

Capitol Airspace conducted a communication systems interference analysis for the LRTP 26 765 kV Route - Gopher to Badger Transmission Link Segment 1 project. This analysis assessed the potential for impact on various systems

In summary, as long as Xcel Energy employs proper installation such as grounding and bonding, and corona suppression mechanisms, and proper maintenance such as checking, repairing and replacing such items periodically, and abiding by all the setback recommendations in this report, the analysis indicates that the proposed transmission line project is not expected to cause significant interference to nearby communication systems. Comprehensive evaluations of AM and FM radio, TV, and Land Mobile Radio services, as well as consideration of nearby communication towers, suggest that any potential impacts can be managed through prudent transmission system installation, management, and maintenance.
If you have any questions regarding the findings of this study, please contact ***David Beranek*** or ***Cindy Cavell*** at (703) 256-2485.

LRTP 26 765 kV Route - Gopher to Badger Transmission Link Segment 2

Xcel Energy

Minnesota

Communication Systems (AM/FM Radio, TV, LMR, and Communications Towers) Interference Analysis

August 14, 2026

Capitol Airspace Group

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Introduction

Capitol Airspace conducted a communication systems interference analysis for the LRTP 26 765 kV Route - Gopher to Badger Transmission Link (GBTL) Segment 2 project in Minnesota. At the time of this analysis, a 116.5 kilometer (72.4 mile) transmission line segment (bright green line, ***Figure 1***) was identified for analysis. The full potential width (black line, ***Figure 1***) was studied as the project boundary. The purpose of this analysis was to identify Amplitude Modulation (AM) and Frequency Modulation (FM) Radio, Television (TV), Land Mobile Radio (LMR) systems, and communications towers potentially carrying E911 service which may be impacted by this project.

AM and FM radio, along with TV stations, are a critical component of the national communications infrastructure. These stations broadcast emergency, news, music, entertainment, and educational content. LMR systems play a critical role in enabling seamless communication among public safety agencies, emergency responders, and transportation services, ensuring swift and coordinated responses to urgent situations and enhancing overall public safety nationwide. Proposed structures that interfere with these systems can degrade the services that they provide.

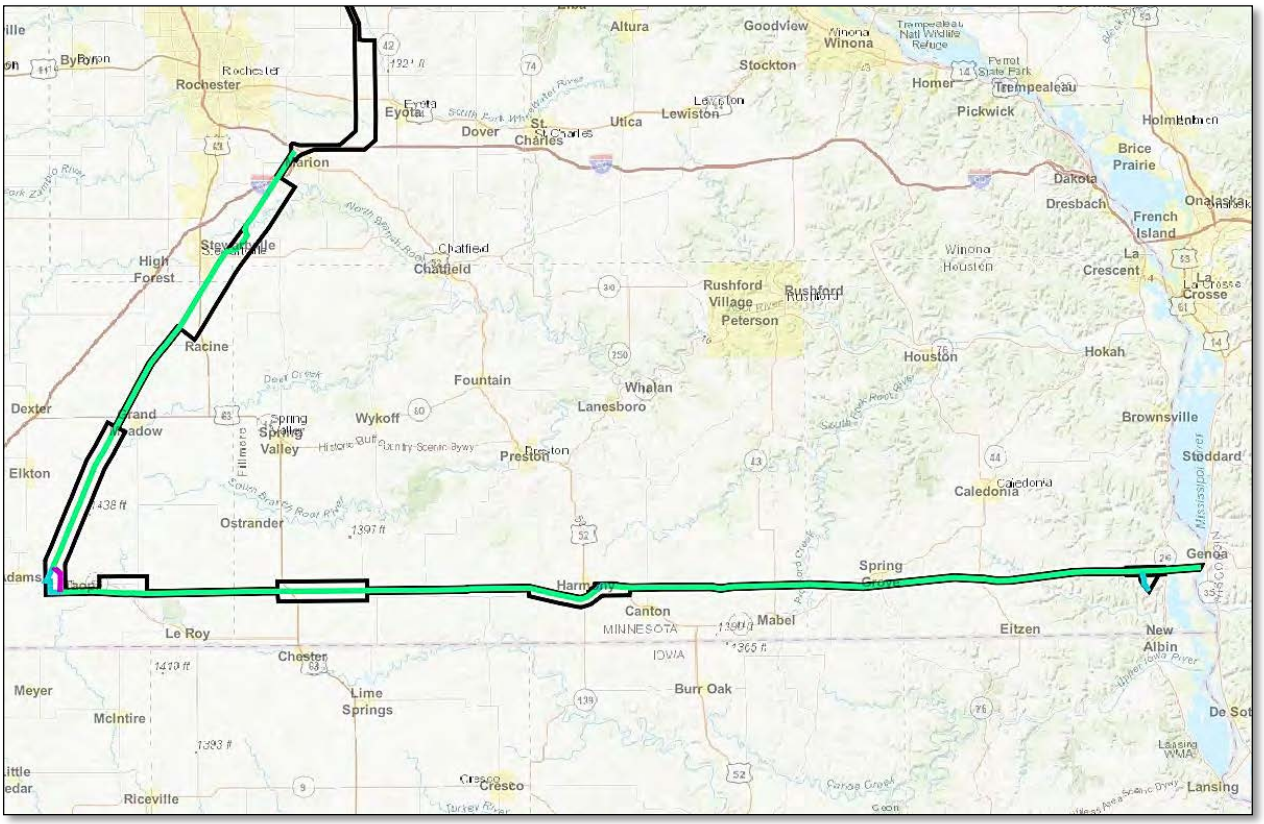


Figure 1: LRTP 26 765 kV Route - Gopher to Badger Transmission Link segment 2

Transmission lines have the potential to disrupt communication systems by physical obstruction of the antenna pattern as well as interference at the receiver. The likelihood of disruption depends on the characteristics of the radio frequency (RF) signal and the proximity of transmission lines to communication system components. Therefore, the proximity of a transmission line to a communication facility plays a crucial role in predicting potential interference. This analysis focuses on understanding how the placement of transmission lines relates to the probability of interference.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. Using this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to communication facilities contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS), Licensing and Management System (LMS), and Antenna Structure Registration (ASR) databases. Additional non-FCC tower databases were also used to determine locations of un-registered towers.

This analysis considers the potential impact of the proposed transmission line project on communication system transmission facilities based on RF signal propagation characteristics, and on RF reception based on Electromagnetic Interference (EMI, or "RF Noise") from the transmission line segments.

AM Radio

Proposed structures located within a certain distance of an AM radio station's transmitter site can have an impact on the station's licensed coverage pattern. The triggering distance for consideration, notification, and possible remedial actions is based on guidance provided by the FCC via 47 CFR §1.30002. If transmission lines are placed within that distance, Xcel Energy should notify the radio station and may have to remediate any issues that arise by that placement. Remediation is relatively simple when done by qualified RF consultants. Properly installed and maintained 765 kV transmission lines of this height should not cause electrical noise to AM reception outside a distance of 100 meters (328 feet).

FM Radio and TV

The location of a proposed structure within an RF signal's propagation regions can determine the potential for impact (***Figure 2***). Within the near field, RF signals behave unpredictably and are more susceptible to distortion from obstacles. In the far field, radio waves are more parallel and uniform and have spread over a larger area. Obstacles in the far field are less likely to have an impact on RF signals. The distance to the end of the near field is called the "Fraunhofer distance". [1]

[1] The Fraunhofer Distance (d_f) is calculated as follows: $d_f = 2D^2/\lambda$, where D is the dimension of the antenna aperture and λ is the wavelength of the signal.

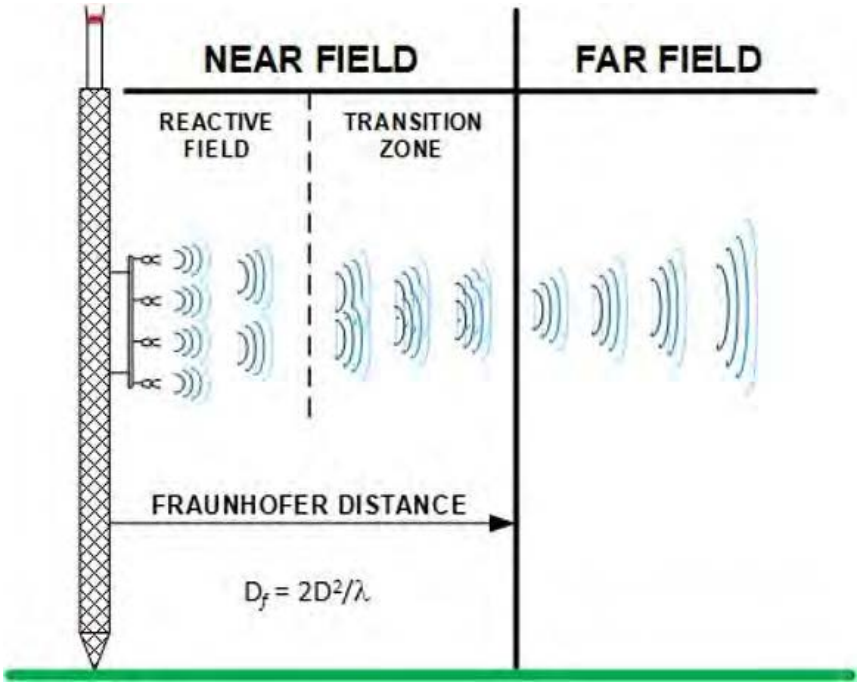


Figure 2: RF signal transition from the near-field to the far-field of a transmitter

LMR and Cellular

Proposed structures like transmission lines also affect LMR and cellular transmission and reception in the same way that they affect FM and TV stations, as the frequencies are similar. The LMR and cellular antennas are evaluated for a worst-case distance from the transmission line so that they are not affected by any physical obstruction of the proposed transmission line.

In many cases, ULS and LMS antenna locations as well as antenna structure registration (ASR) tower locations are inaccurate. When a communication system transmitter's location was critical, available satellite and aerial imagery were used to improve its coordinates. Available imagery was also used to identify potential receivers in proximity to the project boundary.

Findings

AM Radio

AM Radio Transmission

Large metal structures located within ten wavelengths of an AM radio station transmitter site have the potential to adversely affect AM transmission. FCC Rule Section 1.30002 details the notification process that should be undertaken when transmission lines are built near an AM station. This FCC Rule addresses the addition of large structures which can cause the AM station facility to be out of compliance with their FCC license depending on their height and proximity to the AM station. There are no AM stations within the project boundary. KFAN(AM) is the closest AM station to the project. It is a directional AM station at 1270 kHz, 6.9 km west of both segment 1 and segment 2. To satisfy FCC Rule Section 1.30002(b), transmission lines should be sited at least ten wavelengths from a directional AM station. In the case of KFAN(AM), the ten-wavelength distance is 2361 meters (***Table 1*** and light purple circle in ***Figure 3***). Since this 2361-meter notification distance does not intersect the project buffer, there should be no impact to this or any other AM station, and the station does not have to be notified of construction.

AM Radio Reception

Even a properly installed and maintained transmission line[2] has the ability to cause noise through electrical field and magnetic field "coupling" which affects AM receivers. The setback distance from the transmission line to a potential AM receiver is based on the transmission line support structure height which is twice the height of the tallest transmission line tower. The tallest support structure in the project is assumed to be no taller than 200 feet for this analysis, so the setback distance to avoid AM receiver interference in houses and buildings would be 400 feet, or roughly 122 meters. When examining aerial imagery, there appears to be no place where any of the transmission line segments are closer than 122 meters to any habitable buildings where AM receivers might exist. Vehicles traveling on roadways past or under the transmission lines may experience temporary AM reception "buzz", which will dissipate quickly.

Table 1: AM radio transmitters in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2

Licensee	Call Sign	Frequency (kHz)	Antenna	Notification Distance (km)	Distance to Nearest T-Line (km)	Coordinates
IHM Licenses, LLC	KFAN(AM)	1270	Directional	2.36	6.9	43 58 46.90 N, 92 26 51.60 W

[2] Proper installation includes grounding and bonding, and corona suppression mechanisms. Proper maintenance includes checking, repairing and replacing such items periodically.

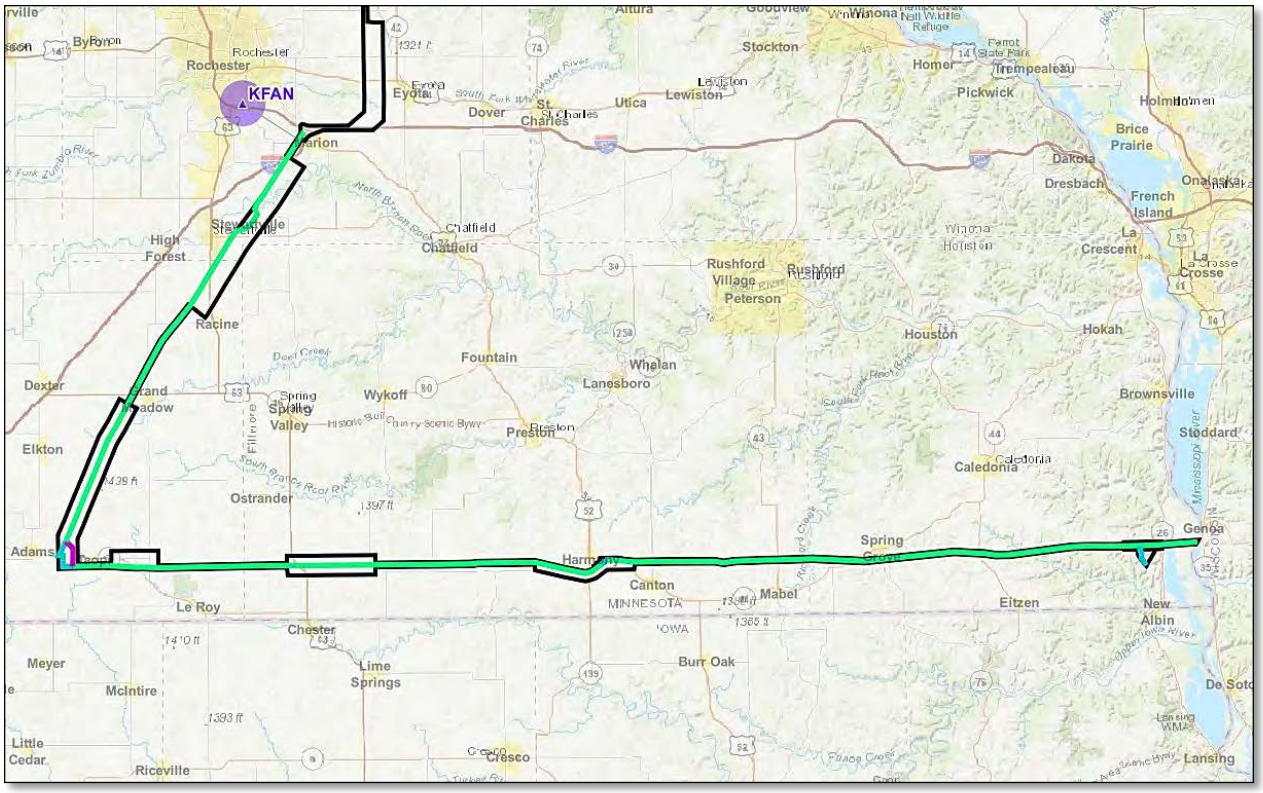


Figure 3: AM radio transmitter (purple triangle) and notification distance (light purple circle) in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2

FM Radio

FM Radio Transmission

The effects of the proposed project on FM radio transmission are predominantly physical in nature. The concern is that tall structures built within an FM transmitting antenna's near field (see ***Figure 2***) will distort the transmitted signal. There is one FM station, KFNL-FM, (***Table 2*** and ***Figure 4***) located within the transmission line segment 2 project area. From the Fraunhofer distance discussion in ***Figure 2***, the KFNL-FM far field distance is only 37 meters. Since the antenna far field distance is less than the distance to the proposed transmission line, there should be no adverse effect on this, or any other nearby FM radio station transmissions. The far field distance is too small to resolve on the map in ***Figure 4***.

FM Radio Reception

Unless the transmission lines are sited within 50 meters (165 feet) of a potential receiver (houses, businesses and roads), it is unlikely that the transmission lines will have a perceivable EMI impact on FM radio reception. Study of aerial imagery indicates that there are no potential houses or buildings within this distance of transmission line segment 2. Vehicles traveling on roads in proximity to the transmission line project should experience only fleeting interruption in signal, if at all.

Table 2: FM radio transmitters within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

Licensee	Call Sign	Status	Frequency (MHz)	Distance to T-Line (m/ft)	Near Field Radius (m)	Corrected Coordinates
Townsquare License, LLC	KFNL-FM	License	104.3	779/2,556	33	43 38 36.00 N, 92 38 50.40 W

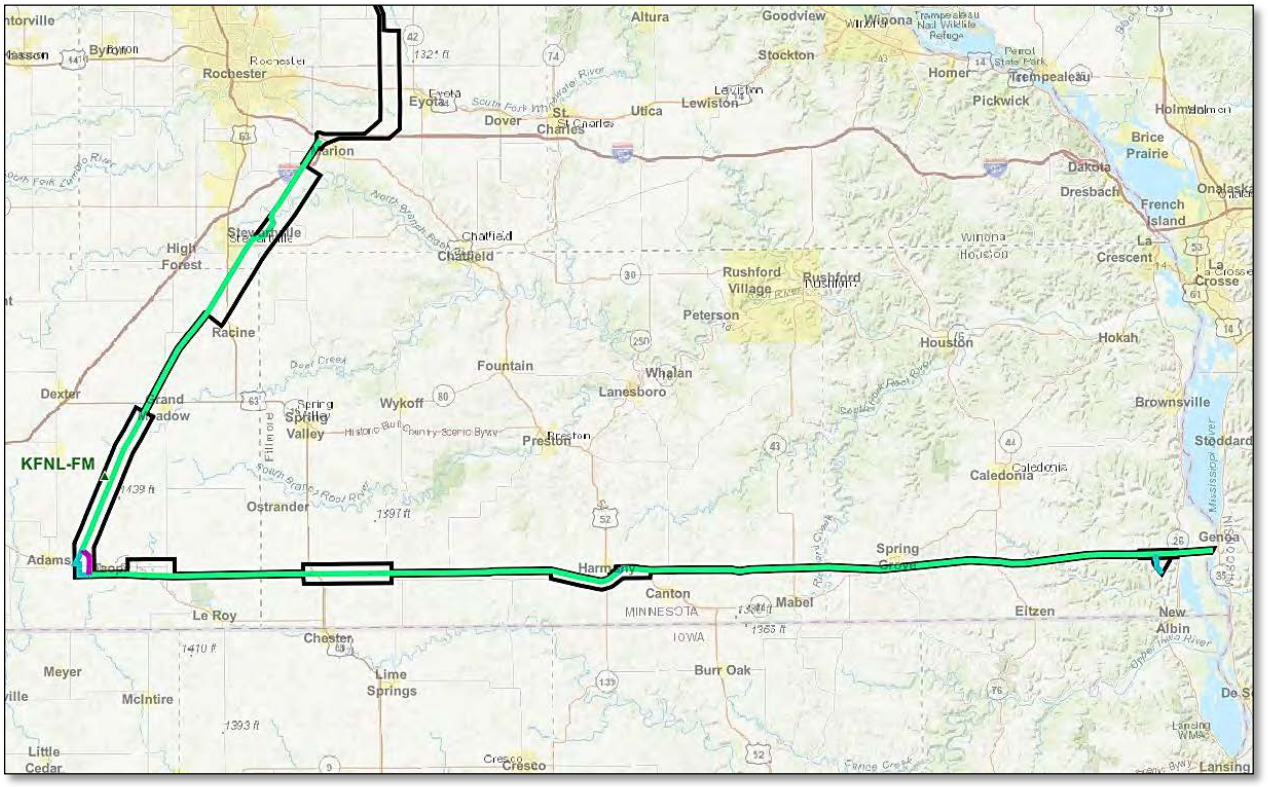


Figure 4: FM radio transmitter (green triangle) within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

Television (TV)

TV Transmission

Similar to FM radio, which is also a "line of sight" service, the effects of the proposed project on TV transmission are predominantly physical in nature. The concern is that tall structures built within the TV transmitting antenna's near field (see ***Figure 2***) will distort the transmitted signal. There are no TV transmitter facilities located within the transmission line project area (***Table 3*** and ***Figure 5***). KTTC-TV is 2.2 km west of the project. From the near field distance discussion in ***Figure 2***, the far-field distance of the KTTC-TV antenna is 272 meters. Since the antenna far field distance is less than the distance to the transmission line segment, there should be no adverse effect on this, or any other nearby TV station transmissions. The far field distance is too small to resolve on the map in ***Figure 5***.

TV Reception

Unless the transmission lines are installed within 50 meters (165 feet) of a potential TV receiver (houses or businesses), it is unlikely that the transmission lines will have a perceivable EMI impact on television reception. Study of aerial imagery indicates that there are no potential houses or buildings within this distance of any of the transmission line segments.

Table 3: TV transmitter in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2

Licensee	Call Sign	Status	Corrected Coordinates	Near Field Radius (m)	Distance to T-Line (m/ft)
Gray Television License, LLC	KTTC-TV	License	43 34 15.00 N, 92 25 38.00 W	272	2,216/7,270

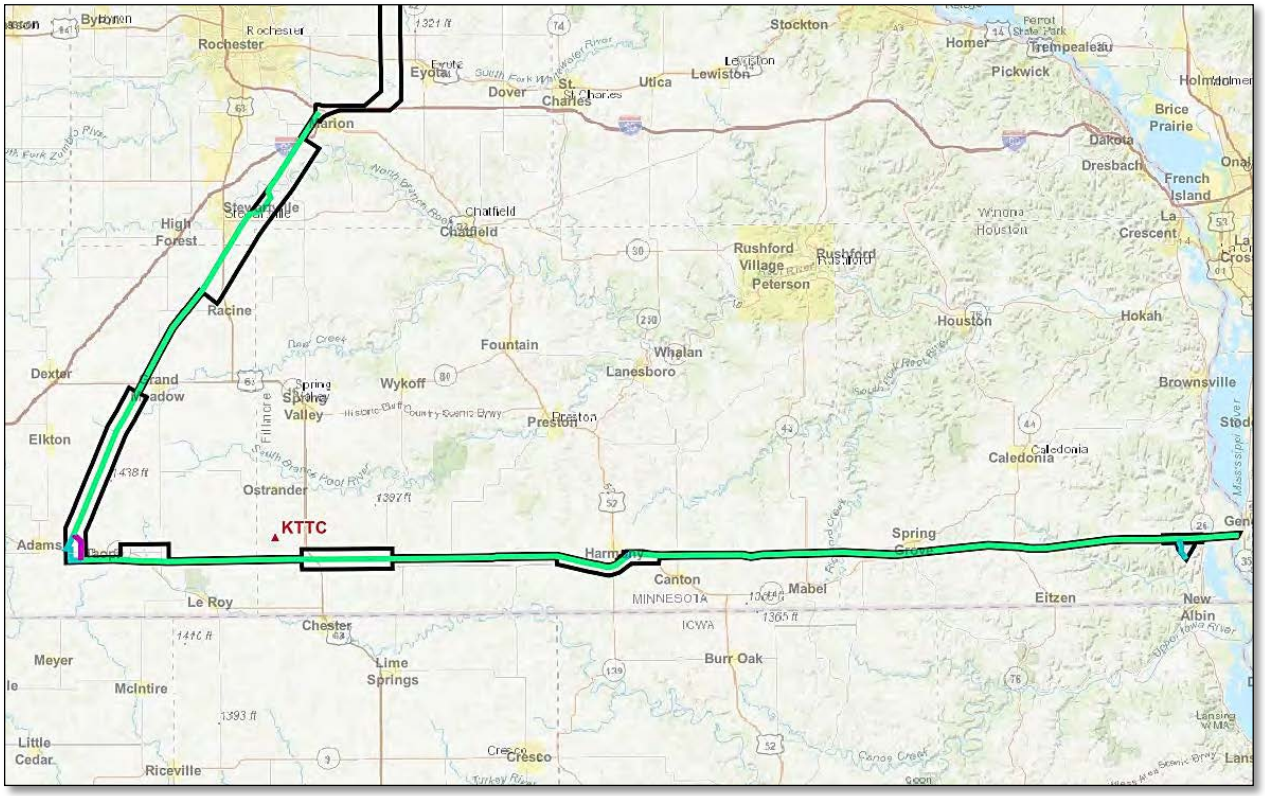


Figure 5: TV transmitter (red triangle) in proximity to LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2

Land Mobile Radio (LMR)

LMR Base Station (Fixed Site) Transmission and Reception

Land mobile radio systems operate at both VHF and UHF, and LMR radios are typically both transmitters and receivers. Unless the transmission lines are sited within 50 meters (165 feet) of a VHF LMR base station radio (houses or businesses), or within 30 meters of a UHF LMR base station, it is unlikely that the transmission lines will have a perceivable EMI impact on transmission or reception. Study of aerial imagery indicates that there are no houses or buildings within this distance of any of the transmission line segments. There are 17 licensed LMR base stations at 12 unique locations within the transmission line project area (***Table 4*** and ***Figure 6***). However, none of them is within 50 meters of the transmission line, so there should be no impact to LMR base station transmission.

Table 4: LMR base stations within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

Licensee	Call Sign	Location	Status	Frequency (MHz)	Distance to T-Line Segment (m/ ft)	Corrected Coordinates
Interstate Power and Light Company	WPBI318	5	License	855.7875/ 856.9125	61/200	43 33 25.15 N, 92 40 52.85 W
Dairyland Power Cooperative	KNNS253	2	License	451.0250/ 451.1000	61/200	43 33 25.15 N, 92 40 52.85 W
Dairyland Power Cooperative	KNNS253	3	License	451.0250/ 451.0500	71/233	43 33 15.55 N, 91 59 22.55 W
Dairyland Power Cooperative	WRBV603	2	License	451.1750/ 451.3750	71/233	43 33 15.55 N, 91 59 22.55 W
Dairyland Power Cooperative	KNHK972	6	License	154.46375	71/233	43 33 15.55 N, 91 59 22.55 W
Harmony, City of	WQXK967	1	License	173.3900	150/492	43 32 37.68 N, 92 00 30.17 W
Oehlke Farms	WQYD346	1	License	451.7250	159/522	43 45 22.10 N, 92 33 13.25 W
Minnesota, State of	WQPT587	1	License	851.4375/ 852.9875	229/751	43 32 39.80 N, 92 00 32.75 W
Dairyland Power Cooperative	KJU719	2	License	153.5600	282/925	43 33 30.70 N, 91 14 00.50 W
Dairyland Power Cooperative	WQSG812	4	License	809.7625/ 810.0125	328/1,076	43 33 32.10 N, 91 13 55.65 W
Dairyland Power Cooperative	WNNC642	1	License	153.6500/ 153.7100	328/1,076	43 33 32.10 N, 91 13 55.65 W
Dairyland Power Cooperative	WQSG812	1	License	854.7625/ 855.0125	402/1,319	43 33 36.85 N, 91 13 49.75 W
Dairyland Power Cooperative	WQSG812	3	License	809.7625/ 810.0125	402/1,319	43 33 36.85 N, 91 13 49.75 W
Hegg, Curt	WNSC241	1	License	460.9250	482/1,581	43 32 45.60 N,92 01 09.60 W
Jones, Terry	WQKM777	1	License	461.5125	511/1,676	43 42 39.95 N, 92 35 48.65 W
Minnesota, State of	WQPT587	1	License	852.3875/ 854.9625	543/1,781	43 32 44.15 N, 92 28 11.85 W
Harmony Agri Services, Inc.	WPHM349	1	License	464.0000	849/2,785	43 33 16.55 N, 92 00 08.25 W

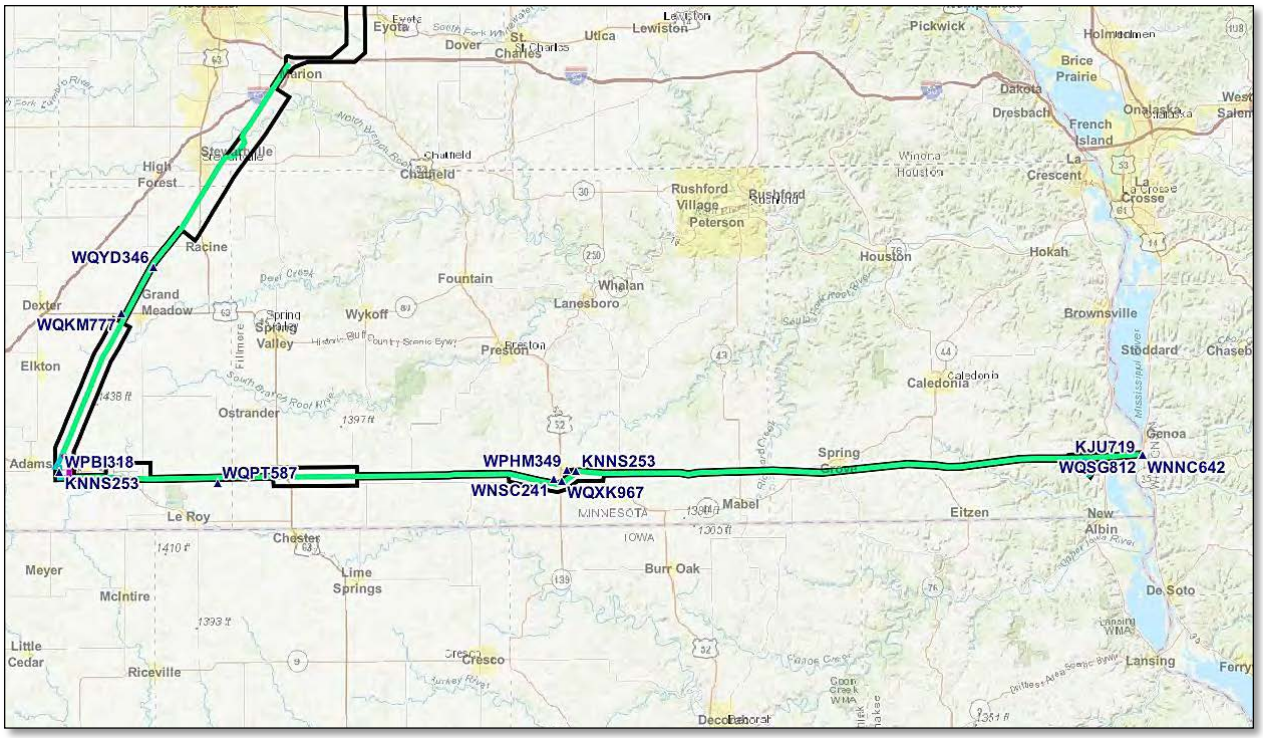


Figure 6: LMR Licenses (dark blue triangles) within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

LMR Mobile Transmission and Reception

The signal from a mobile LMR radio is generally broad and can scatter around intervening physical objects like transmission lines, and typical LMR systems employ redundant systems such as multiple transceivers in their design as a means of ensuring service in a region, so there should be little impact to LMR mobile reception. Since mobile radios are frequently in motion, users of handheld radios often adjust their positions to address any interference. There should be no impact from the transmission line project to land mobile radio licenses.

Other Communications Towers – Cellular Service and E911 Signaling

The primary concern with antenna towers not identified in the sections above is the potential for interference to cellular service. Similar to LMR radios, cellular radio systems on towers both transmit and receive. There are ten[3] known communications towers or cellular licenses within the proposed transmission line project area (***Table 5*** and ***Figure 7***). However, unless the transmission lines are sited within 30 meters (98 feet) of a tower with a cellular radio, there should be no impact from the transmission line to either cellular transmission or reception. In fact, there are many cases in the U.S. where there is cellular service mounted on towers either directly next to or on high-power transmission line towers; There should be no impact to any cellular service or E911 signaling from the transmission line project.

[3] See notes 4-6.

Table 5: Communications towers within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

Tower Number	Tower Owner	Height Above Ground (m)	Distance to Nearest T-Line (m/ft)	Corrected Coordinates
1221624	Dairyland Power Cooperative	79.3	61/200	43 33 25.15 N, 92 40 52.85 W
1332224[4]	Cloud 1 Services, LLC	77.4	139/456	43 32 34.30 N, 92 00 12.30 W
1331764[5]	Cloud 1 Services, LLC	92.7	189/620	43 33 10.10 N, 91 31 09.60 W
ATC 91814	American Towers LLC	54.9	216/709	43 55 02.95 N, 92 24 16.72 W
1244891	American Towers LLC	80.8	239/784	43 33 07.20 N, 91 50 40.10 W
1054363	SBA Structures, LLC	97.5	263/863	43 49 59.30 N, 92 28 40.85 W
1043296	Townsquare Media Rochester, LLC	152.4	782/2,566	43 38 36.00 N, 92 38 50.40 W
ATC 417947	American Towers LLC	54.9	989/3,245	43 42 21.60 N, 92 34 46.20 W
ATC 414462	American Towers LLC	58.8	1,187/3,894	43 56 37.75 N, 92 21 35.30 W
1292077	American Towers LLC	88.4	1,350/4,429	43 32 15.70 N, 92 23 15.70 W
1024071[6]	KVGO Inc. dba COOL 104	153	N/A	43 33 41.00 N, 92 35 45.00 W

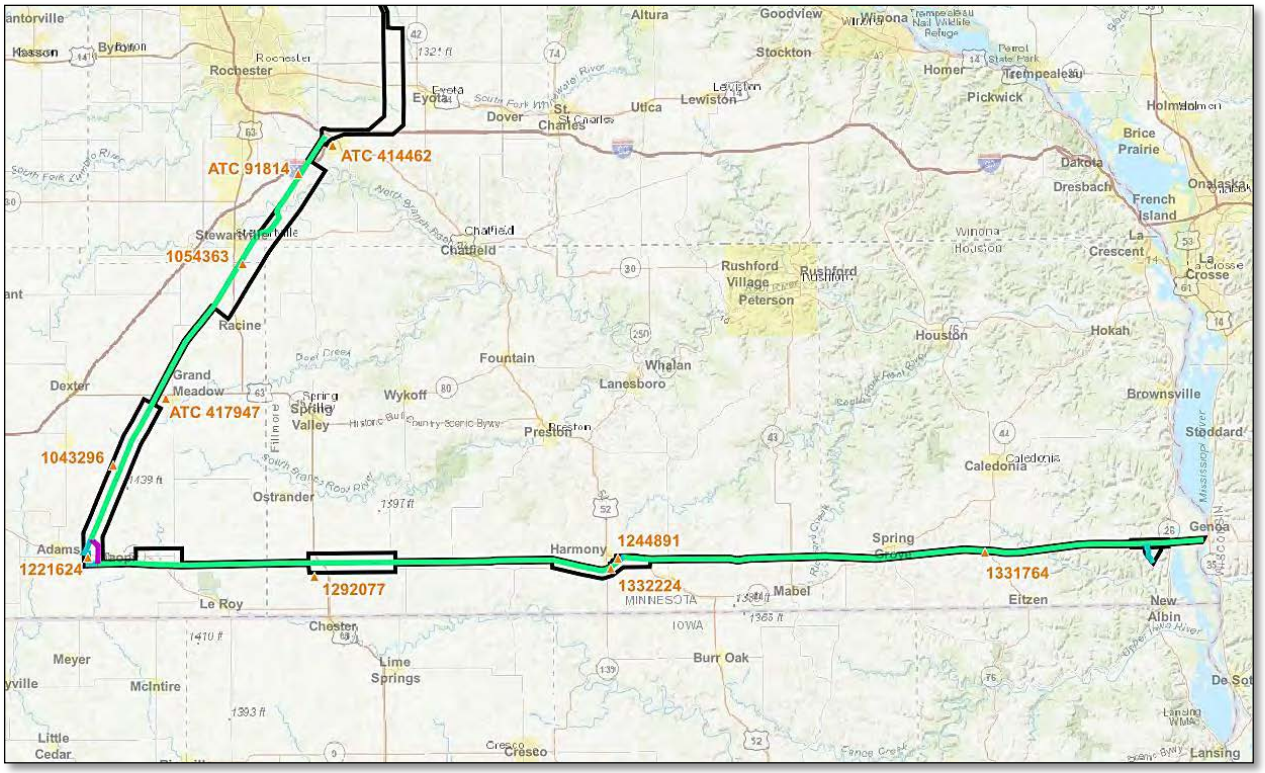


Figure 7: Towers (orange triangles) within the LRTP 26 765 kV Route – Gopher to Badger Transmission Link segment 2 project area

[4] This tower has been granted an Antenna Structure Registration (ASR) number but has not been built yet.

[5] This tower has been granted an Antenna Structure Registration (ASR) number but has not been built yet.

[6] This tower has not been removed from the ASR database, but it does not exist any longer. It is not included in the tower count or on the map in Figure 7.

Conclusion

Capitol Airspace conducted a communication systems interference analysis for the LRTP 26 765 kV Route - Gopher to Badger Transmission Link Segment 2 project. This analysis assessed the potential for impact on various systems

In summary, as long as Xcel Energy employs proper installation such as grounding and bonding, and corona suppression mechanisms, and proper maintenance such as checking, repairing and replacing such items periodically, and abiding by all the setback recommendations in this report, the analysis indicates that the proposed transmission line project is not expected to cause significant interference to nearby communication systems. Comprehensive evaluations of AM and FM radio, TV, and Land Mobile Radio services, as well as consideration of nearby communication towers, suggest that any potential impacts can be managed through prudent transmission system installation, management, and maintenance.
If you have any questions regarding the findings of this study, please contact ***David Beranek*** or ***Cindy Cavell*** at (703) 256-2485.

GBTL Segment 1
Transmission Line Project

Xcel Energy

Goodhue, Olmsted, and Wabasha Counties, Minnesota

Microwave Path Analysis

Analysis by Candace Childress

October 16, 2026

Capitol Airspace Group
capitolairspace.com
(703) 256 - 2485

Introduction

Capitol Airspace conducted a microwave path analysis for the LRTP 26 765 kV Route – Gopher to Badger Transmission Link Segment 1 [GBTL Segment 1] project in Goodhue, Olmsted, and Wabasha Counties, Minnesota. The purpose of this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit the placement of a transmission line. This analysis assessed microwave links overlying a 457 to 2,205-meter-wide corridor (solid black outline, ***Figure 1***) surrounding approximately 63 kilometers of proposed routing (dashed black line, ***Figure 1***) to determine if a transmission line could obstruct microwave path Fresnel zones.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry and utility applications. To ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions. Proposed structures that create a line-of-sight obstruction can degrade signal reliability and could require revisions to the microwave system.

Proposed structures that intersect a microwave link's Fresnel zone can create a line-of-sight obstruction that degrades link performance. Depending on the proposed structure type, the percentage of the Fresnel zone obstructed, and the microwave system configuration, this impact could degrade signal reliability and require revisions to the microwave system.

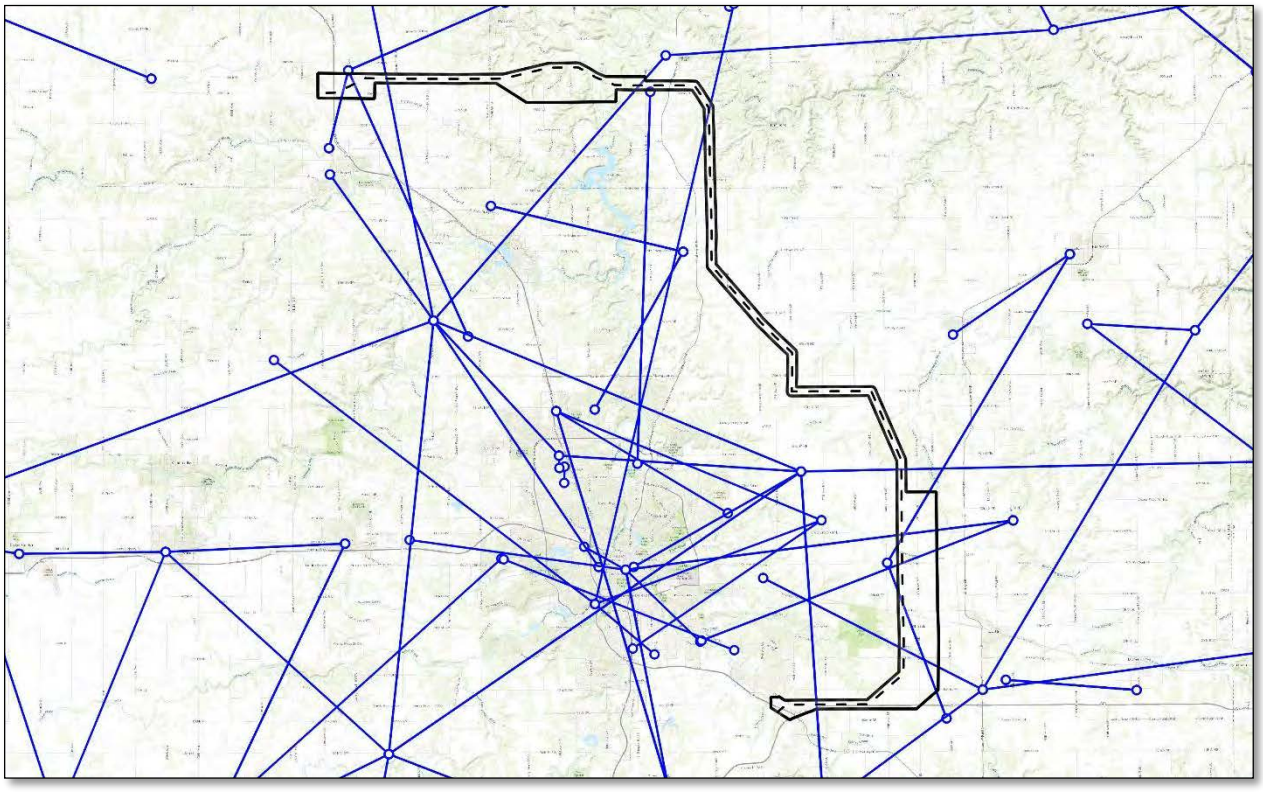


Figure 1: Licensed microwave links (blue) in proximity to the GBTL Segment 1 transmission line project

Capitol Airspace maintains a microwave path database based on FCC ULS data. This data includes daily transaction files that contain ULS database changes for the preceding day. As a result, the microwave path data assessed and presented in this report is accurate through the day preceding the report date.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. With this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communications Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (***Figure 2***). The first Fresnel zone is a three-dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where $d_1 = d_2$) and is inversely related to the path frequency. Higher frequencies result in smaller Fresnel zone radii while lower frequencies result in larger Fresnel zone radii.

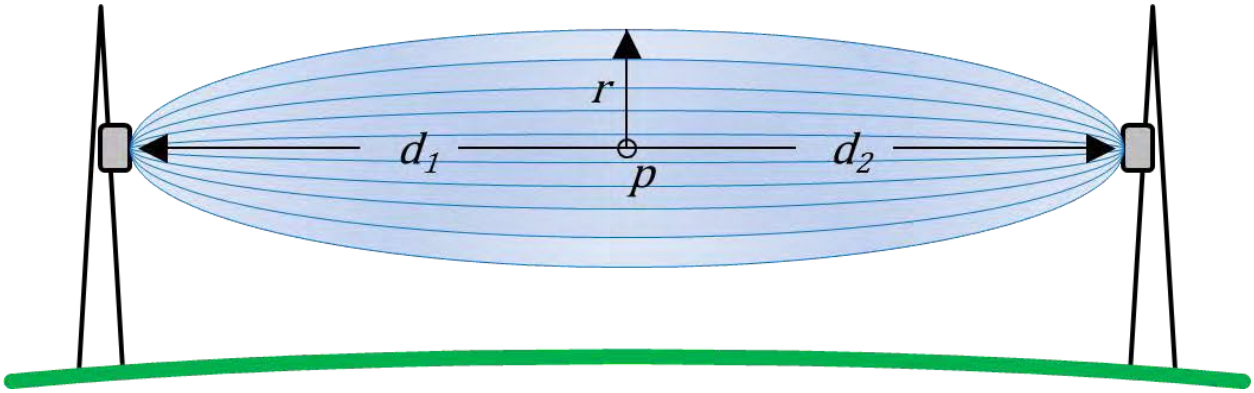


Figure 2: Fresnel zone example

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate (e.g. ***Figure 3***). Available satellite and aerial imagery were used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.

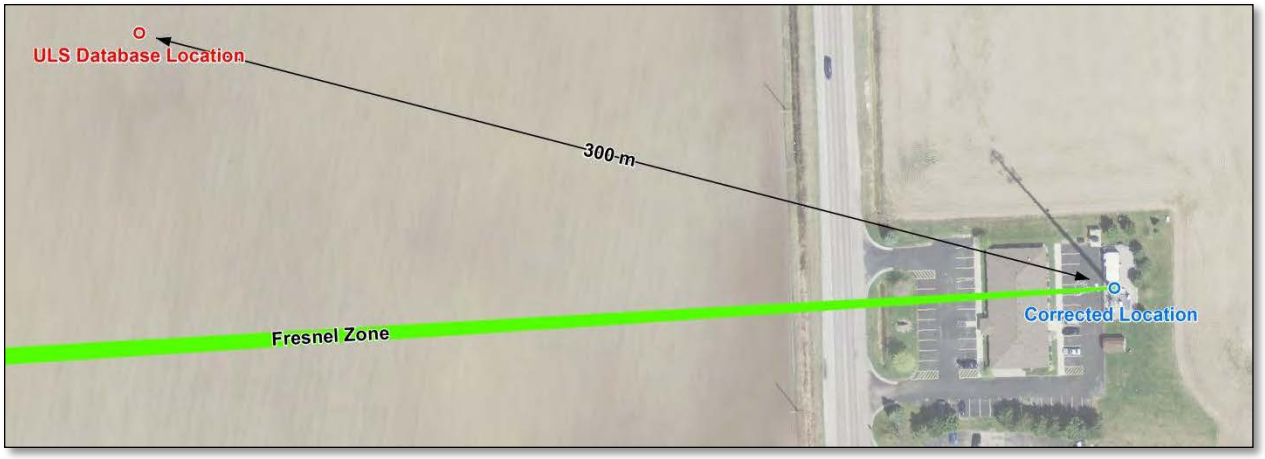


Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location

Findings

Thirteen microwave links with 34 paths overlie the GBTL Segment 1 transmission line project (***Table 1*** & ***Figure 4***). Based on elevation data sampled at a 1-meter resolution from the United States Geological Survey 3D Elevation Program (3DEP) and FCC ULS antenna height information, the height of the Fresnel zones ranges from 10 to 450 feet above ground level (AGL) where they overlie the study area.

Table 1: Microwave paths with Fresnel zones overlying the GBTL Segment 1 transmission line project

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz)[1]	AGL Height (feet) over Study Area	
							Min	Max
AT&T Mobility Spectrum, LLC	WQWS982	5	Licensed	ZUMBROTA	PINE ISLAND	17765.00	119	230
		6	Licensed	ZUMBROTA	PINE ISLAND	17815.00	119	230
	WQWS983	4	Licensed	PINE ISLAND	ZUMBROTA	19325.00	120	230
		5	Licensed	PINE ISLAND	ZUMBROTA	19375.00	120	230
Dairyland Power Cooperative	WPRR524	1	Licensed	ROCHESTER MN	EYOTA MN	6871.25	70	210
	WPRR532	3	Licensed	EYOTA MN	ROCHESTER MN	6526.25	70	211
IHM LICENSES, LLC	WPNM431	1	Licensed	Location 1	Location 2	948.50	83	450
Minnesota, State of	WPQY855	5	Licensed	Viola	Elba	6555.63	58	184
		6	Licensed	Viola	Pleasant Grove	6595.00	156	293
	WQCT665	6	Licensed	Zumbrota	New Haven	6004.50	154	283
	WQCT701	4	Licensed	New Haven	Zumbro Falls	6123.10	51	189
		6	Licensed	New Haven	Zumbrota	6256.54	155	282
	WQIK561	4	Licensed	Pleasant Grove	Viola	6755.00	157	293
	WQJE437	1	Licensed	Elba	Viola	6725.63	58	183
	WQJG359	2	Licensed	Zumbro Falls	New Haven	6375.14	51	188
New Cingular Wireless PCS, LLC	WQRI981	2	Licensed	EYOTA	VIOLA	11225.00	42	180
		3	Licensed	EYOTA	VIOLA	11265.00	42	180
	WQRI982	3	Licensed	VIOLA	EYOTA	10735.00	42	180
		4	Licensed	VIOLA	EYOTA	10775.00	42	180
		5	Licensed	VIOLA	PLAINVIEW	6197.24	125	325
		6	Licensed	VIOLA	PLAINVIEW	6226.89	125	324
	WQTH380	2	Licensed	PLAINVIEW	VIOLA	5945.20	124	325
		3	Licensed	PLAINVIEW	VIOLA	5974.85	124	325
Olmsted County Sheriffs Office	WQDW722	3	Licensed	VIOLA	PLEASANT GRV	6595.00	156	293
	WQDW720	1	Licensed	PLEASANT GRV	VIOLA	6755.00	157	293
SmartSky Microwave, LLC	WQZW914	1	Licensed	MN103B-MWA	MN103B	10775.00	80	195
		2	Licensed	MN103B-MWA	MN103B	10735.00	80	195
	WQZW915	1	Licensed	MN103B	MN103B-MWA	11265.00	80	194
		2	Licensed	MN103B	MN103B-MWA	11225.00	80	194
Townsquare License, LLC	WQFN697	1	Licensed	KOLM	KDZZ SITE	951.00	11	280
	WQIQ891	1	Licensed	Townsquare Studio	Eyota Site	951.00	127	432
	WQIQ893	1	Licensed	KOLM	KDZZ SITE	946.50	10	280
	WRCL480	1	Licensed	Townsquare Studio	Eyota Site	6212.07	169	333
	WRCL481	1	Licensed	Eyota Site	Townsquare Studio	5960.03	168	334

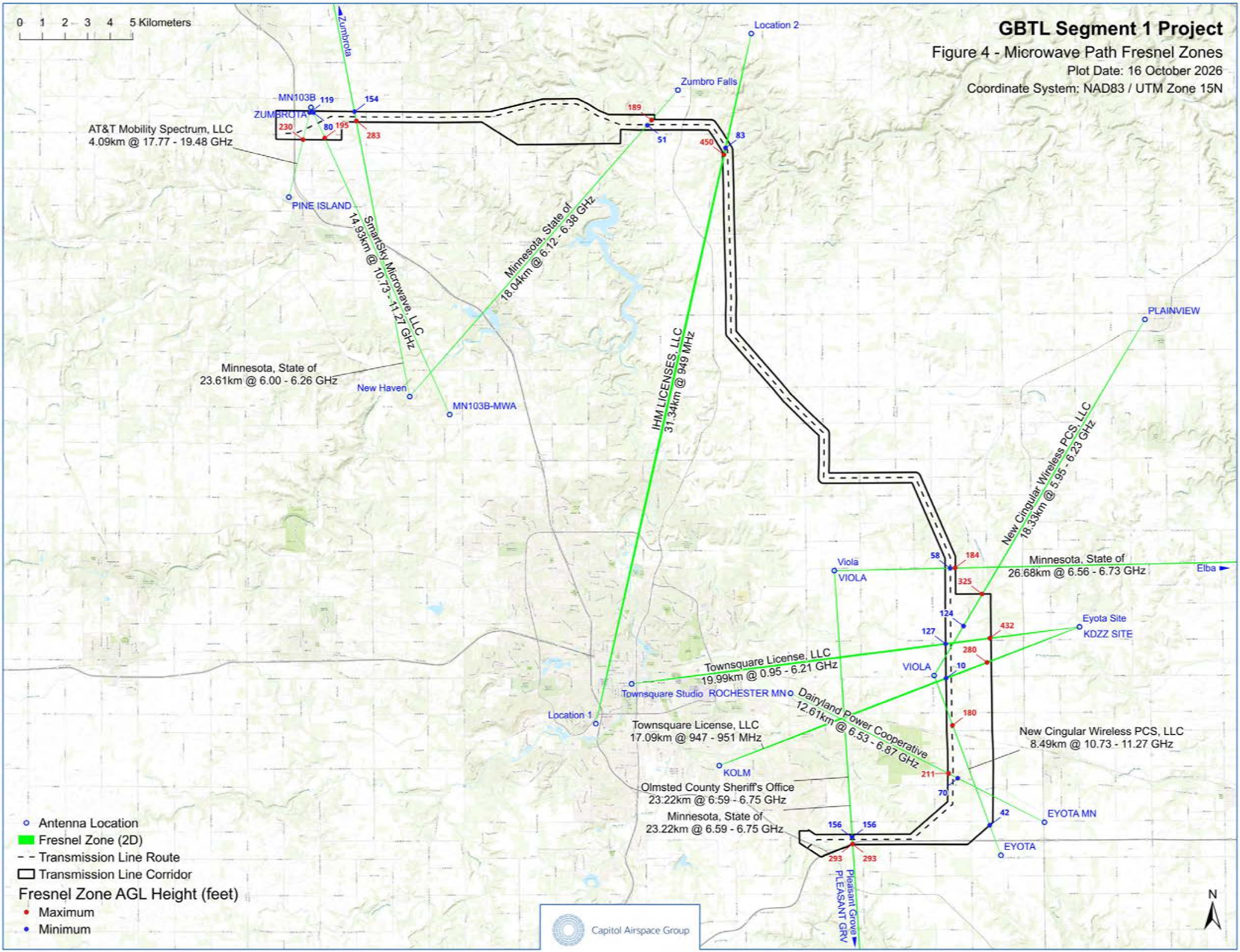
[1] Microwave paths may be licensed to operate using more than one frequency. To calculate Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.

Conclusion

The results of this analysis indicate that 34 paths associated with 13 microwave links overlie the GBTL Segment 1 transmission line project. The associated Fresnel zones (green, ***Figure 4***) cross the study area at heights ranging from 10 to 450 feet AGL (blue and red points, ***Figure 4***). Transmission line towers located within the potentially affected Fresnel zones could create a physical obstruction that degrades signal performance and reliability. As a result, the transmission line towers should be sited outside of the two-dimensional Fresnel zones. Alternatively, if towers are located within a two-dimensional Fresnel zone, they should be lower than the potentially affected link's Fresnel zone minimum AGL height (see "Min" column ***Table 1*** or blue points, ***Figure 4***).

Additionally, catenary wires could also interfere with microwave links depending on tower placement and wire sag. Additional three-dimensional analysis would be required to determine if catenary wires intersect the Fresnel zones. If they do, signal degradation could occur depending on the microwave system characteristics. These characteristics include, but are not limited to, path frequency, antenna polarization, and modulation scheme.

If you have any questions regarding the findings of this study, please contact ***David Beranek*** or ***Candace Childress*** at (703) 256-2485.


0 1 2 3 4 5 Kilometers
GBTL Segment 1 Project
Figure 4 - Microwave Path Fresnel Zones
Plot Date: 16 October 2026
Coordinate System: NAD83 / UTM Zone 15N
Zumbrota
Location 2
Zumbro Falls
MN103B
ZUMBROTA
AT&T Mobility Spectrum, LLC
4.09km @ 17.77 - 19.48 GHz
PINE ISLAND
SmartSky Microwave, LLC
14.93km @ 10.73 - 11.27 GHz
Minnesota, State of
18.04km @ 6.12 - 6.38 GHz
Minnesota, State of
23.61km @ 6.00 - 6.26 GHz
New Haven
MN103B-MWA
IHM LICENSES, LLC
31.34km @ 949 MHz
PLAINVIEW
New Cingular Wireless PCS, LLC
18.33km @ 5.95 - 6.23 GHz
Viola
VIOLA
Minnesota, State of
26.68km @ 6.56 - 6.73 GHz
Elba
Eyota Site
KDZZ SITE
Townsquare License, LLC
19.99km @ 0.95 - 6.21 GHz
Townsquare Studio ROCHESTER MN
Location 1
Townsquare License, LLC
17.09km @ 947 - 951 MHz
Dairyland Power Cooperative
12.61km @ 6.53 - 6.87 GHz
KOLM
Olmsted County Sheriff's Office
23.22km @ 6.59 - 6.75 GHz
Minnesota, State of
23.22km @ 6.59 - 6.75 GHz
New Cingular Wireless PCS, LLC
8.49km @ 10.73 - 11.27 GHz
EYOTA MN
EYOTA
Pleasant Grove
PLEASANT GRV
Antenna Location
Fresnel Zone (2D)
Transmission Line Route
Transmission Line Corridor
Fresnel Zone AGL Height (feet)
Maximum
Minimum
Capitol Airspace Group
N

GBTL Segment 2 Transmission Line Project

Xcel Energy

Fillmore, Houston, Mower, and Olmsted Counties, Minnesota

Microwave Path Analysis

Analysis by Candace Childress

October 16, 2026

Capitol Airspace Group

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Introduction

Capitol Airspace conducted a microwave path analysis for the LRTP 26 765 kV Route – Gopher to Badger Transmission Link Segment 2 [GBTL Segment 2] project in Fillmore, Houston, Mower, and Olmsted Counties, Minnesota. The purpose of this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit the placement of a transmission line. This analysis assessed microwave links overlying a 457 to 2,012-meter-wide corridor (solid black outline, ***Figure 1***) surrounding approximately 169 kilometers of proposed routing (dashed black line, ***Figure 1***) to determine if a transmission line could obstruct microwave path Fresnel zones.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry and utility applications. To ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions. Proposed structures that create a line-of-sight obstruction can degrade signal reliability and could require revisions to the microwave system.

Proposed structures that intersect a microwave link's Fresnel zone can create a line-of-sight obstruction that degrades link performance. Depending on the proposed structure type, the percentage of the Fresnel zone obstructed, and the microwave system configuration, this impact could degrade signal reliability and require revisions to the microwave system.

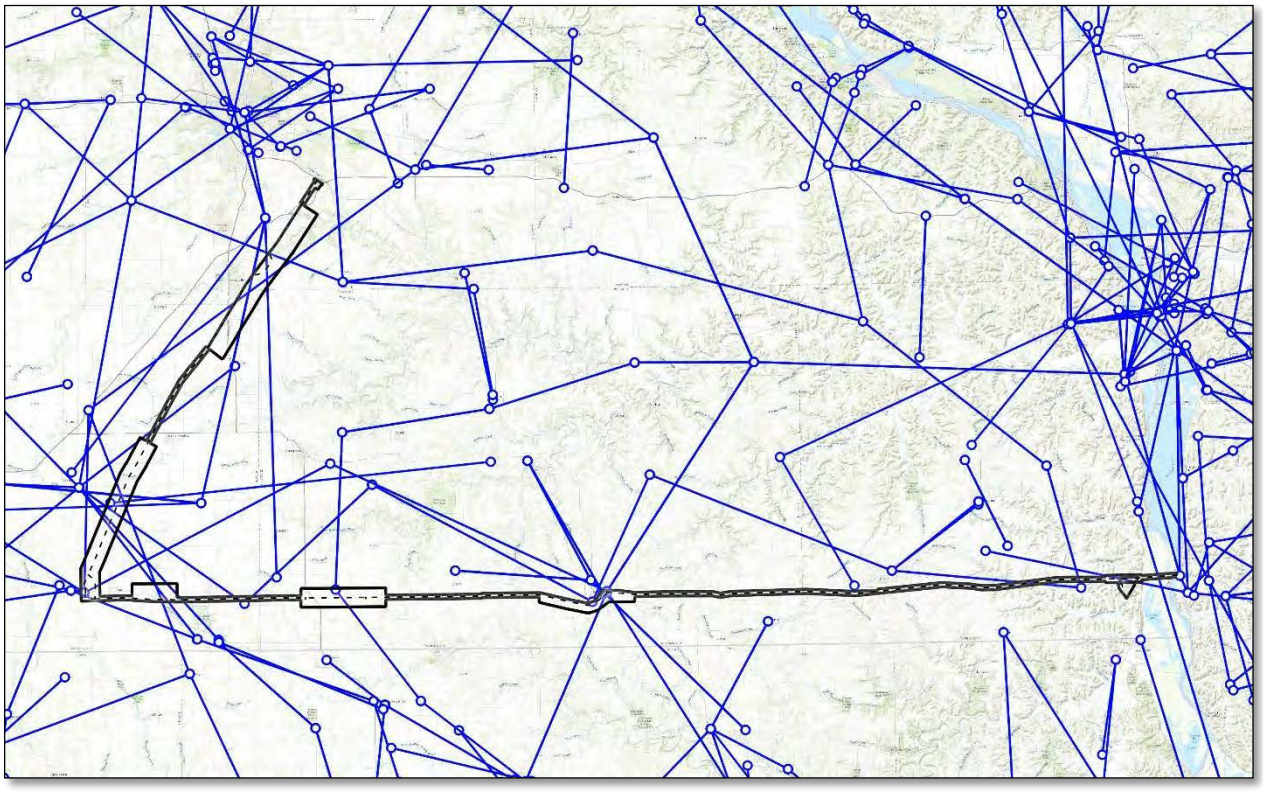


Figure 1: Licensed microwave links (blue) in proximity to the GBTL Segment 2 transmission line project

Capitol Airspace maintains a microwave path database based on FCC ULS data. This data includes daily transaction files that contain ULS database changes for the preceding day. As a result, the microwave path data assessed and presented in this report is accurate through the day preceding the report date.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. With this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communications Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (***Figure 2***). The first Fresnel zone is a three-dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where $d_1 = d_2$) and is inversely related to the path frequency. Higher frequencies result in smaller Fresnel zone radii while lower frequencies result in larger Fresnel zone radii.

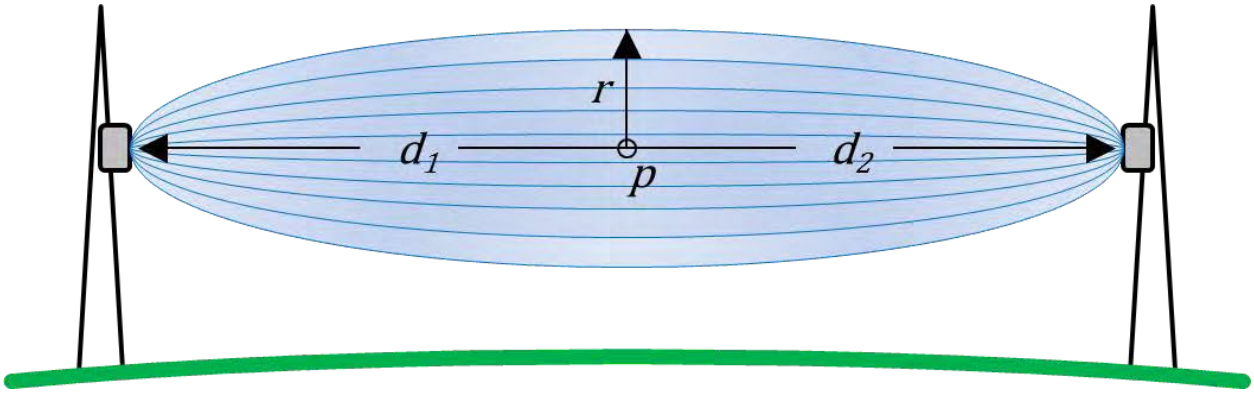


Figure 2: Fresnel zone example

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate (e.g. ***Figure 3***). Available satellite and aerial imagery were used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.

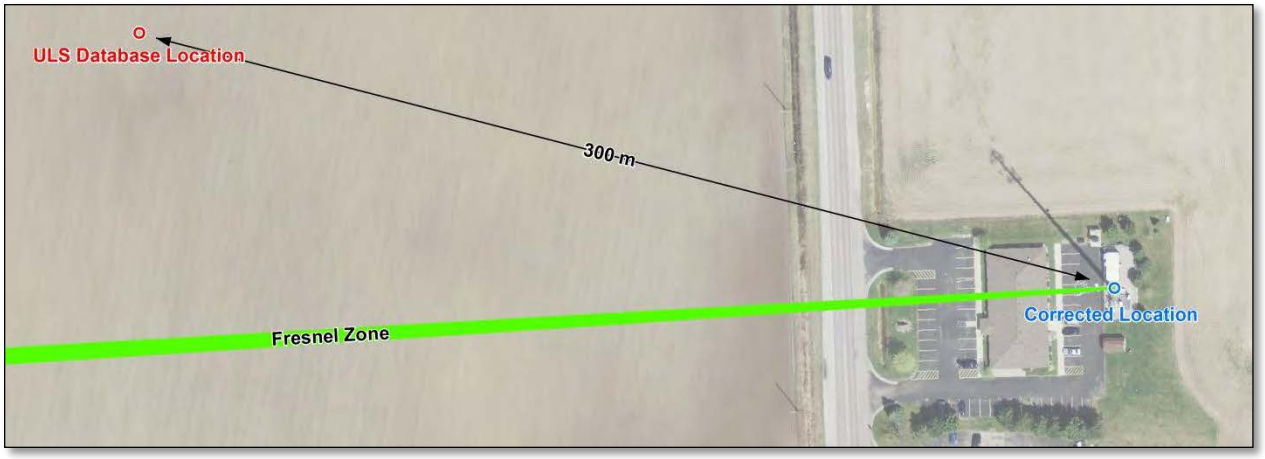


Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location

Findings

Thirty-three microwave links with 71 paths overlie the GBTL Segment 2 transmission line project (***Table 1*** & ***Figures 4***, ***5***, ***6***, ***7***). Based on elevation data sampled at a 1-meter resolution from the United States Geological Survey 3D Elevation Program (3DEP) and FCC ULS antenna height information, the height of the Fresnel zones ranges from the surface to 620 feet above ground level (AGL) where they overlie the study area.

Table 1: Microwave paths with Fresnel zones overlying the GBTL Segment 2 transmission line project

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz)[1]	AGL Height (feet) over Study Area	
							Min	Max
AT&T Mobility Spectrum, LLC	WQWV211	2	Licensed	HARMONY	PRESTON	6226.89	140	178
		3	Licensed	HARMONY	PRESTON	6256.54	140	178
	WQWV212	2	Licensed	PRESTON	HARMONY	5974.85	139	178
		3	Licensed	PRESTON	HARMONY	6004.50	139	178
BNSF Railway Co.	WPON486	4	Licensed	Lansing	Reno	5960.03	472	620
	WPON487	1	Licensed	Reno	Lansing	6197.24	497	618
		3	Licensed	Reno	Lansing	6212.07	473	618
Dairyland Power Cooperative	WPRR526	1	Licensed	RUSHFORD, MN	HARMONY MN	6565.00	91	111
		4	Licensed	RUSHFORD, MN	HARMONY MN	6565.00	91	111
	WPRR528	1	Licensed	HARMONY MN	RUSHFORD MN	6735.00	91	111
		2	Licensed	HARMONY MN	RUSHFORD MN	6735.00	91	111
	WPRR532	2	Licensed	EYOTA MN	DEXTER MN	6315.84	66	339
	WPRR543	1	Licensed	DEXTER MN	EYOTA MN	6063.80	59	340
		2	Licensed	DEXTER MN	LEROY IA	6004.50	100	356
		3	Licensed	DEXTER MN	ADAMS, MN	6034.15	107	236
	WPRR544	1	Licensed	LEROY IA	DEXTER MN	6256.54	84	355
	WQKD951	1	Licensed	ADAMS, MN	DEXTER, MN	6286.19	108	235
		2	Licensed	ADAMS, MN	MURPHY CREEK, MN	6152.75	149	197
	WQMY737	3	Licensed	GENOA HILL, WI	CALEDONIA	941.75	0	484
	WQRX918	2	Licensed	MURPHY CREEK, MN	ADAMS, MN	6404.79	149	196
	WRAN273	1	Licensed	CALEDONIA	GENOA HILL	932.75	0	485
GRAY TELEVISION LICENSE, LLC	WPWH285	1	Licensed	Simpson Tower	Ostrander Tower	7012.50	131	302
Gray Television Licensee, LLC	WQCM789	1	Licensed	Simpson Twr	KXLT-TV	6962.50	98	302
Interstate Power and Light Company	WEG332	2	Licensed	DECORAH HILL	HARMONY	5945.20	82	193
	WEG334	1	Licensed	SPRING VALLEY	ADAMS SUB	6093.45	144	284
		2	Licensed	SPRING VALLEY	HARMONY	6063.80	87	165
	WEG335	1	Licensed	ADAMS SUB	SPRING VALLEY	6345.49	144	284
		4	Licensed	ADAMS SUB	HAYWARD	6226.89	173	273
	WEG336	2	Licensed	HAYWARD	ADAMS SUB	5974.85	173	274
	WPSF367	1	Licensed	HARMONY	DECORAH HILL	6197.24	83	193
		2	Licensed	HARMONY	SPRING VALLEY	6315.84	87	164

[1] Microwave paths may be licensed to operate using more than one frequency. To calculate Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.

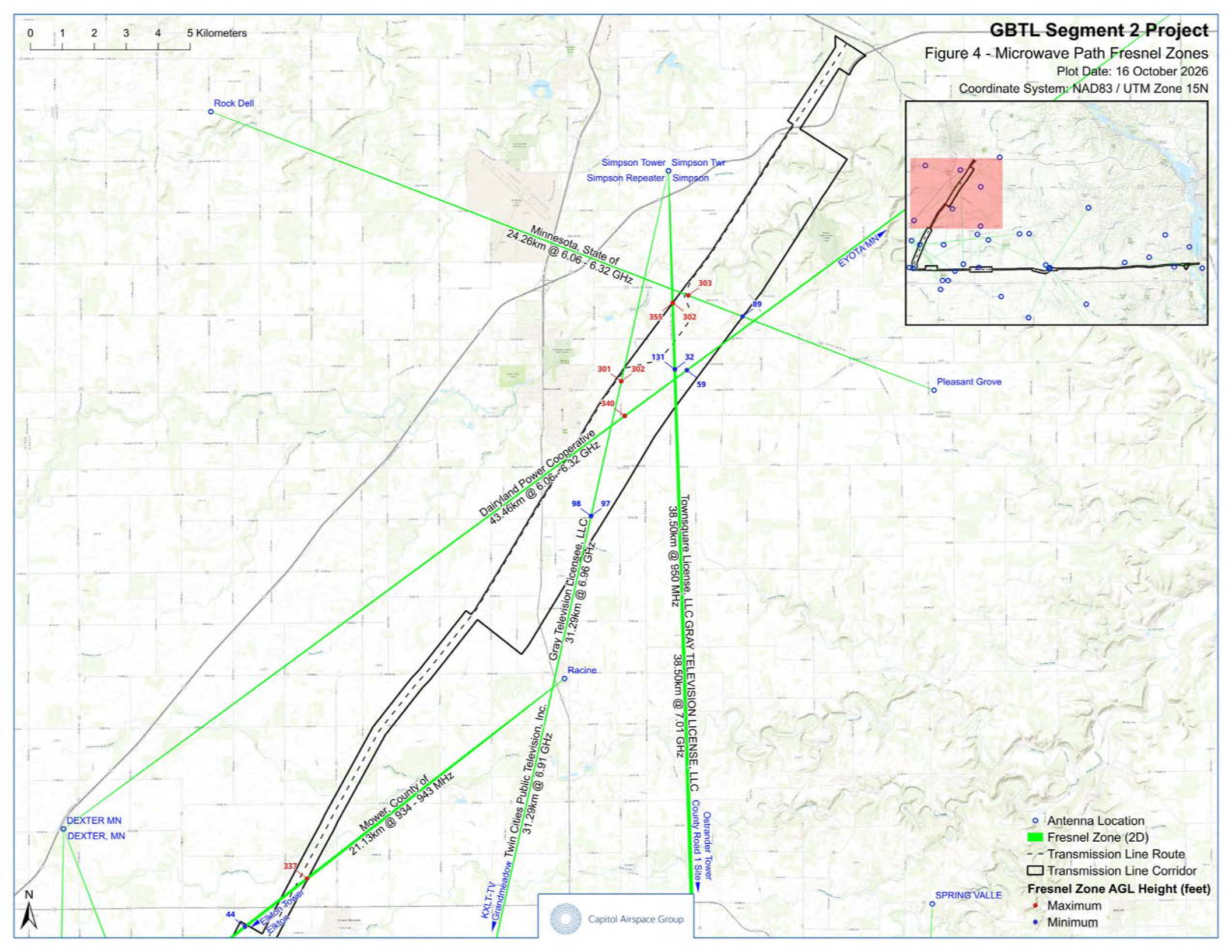
Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz)[1]	AGL Height (feet) over Study Area	
							Min	Max
KAAL-TV, LLC	WQKZ238	1	Licensed	MYRTLE TOWER	GRAND MEADOW	7062.50	121	261
MiBroadband	WREC651	1	Licensed	Main Tower	Remote Site	11155.00	83	166
		2	Licensed	Main Tower	Remote Site	11155.00	83	166
	WREC654	1	Licensed	Remote Site	Main Tower	11645.00	84	165
		2	Licensed	Remote Site	Main Tower	11645.00	84	165
Midcontinent Communications	WRUQ907	1	Licensed	MNMW0009	MNMW0008	10995.00	171	246
		2	Licensed	MNMW0009	MNMW0006	10755.00	162	313
	WRUQ908	1	Licensed	MNMW0008	MNMW0009	11485.00	172	246
	WRUQ909	1	Licensed	MNMW0006	MNMW0009	11245.00	162	313
MiEnergy Cooperative	WRAJ580	1	Licensed	DPC HARMONY	DPC RUSHFORD	11485.00	107	124
		2	Licensed	DPC HARMONY	DPC RUSHFORD	11485.00	107	124
		3	Licensed	DPC HARMONY	CRESCO OFFICE	11485.00	98	183
		4	Licensed	DPC HARMONY	CRESCO OFFICE	11485.00	98	183
	WRAJ581	1	Licensed	DPC RUSHFORD	DPC HARMONY	10995.00	107	125
		2	Licensed	DPC RUSHFORD	DPC HARMONY	10995.00	107	125
	WRAJ870	1	Licensed	CRESCO OFC	DPC HARMONY	10995.00	112	199
		2	Licensed	CRESCO OFC	DPC HARMONY	10995.00	112	199
	WRDB836	3	Licensed	SPRING VALLE	CHERRY GROVE	11485.00	102	115
	WRJJ758	1	Licensed	CHERRY GROVE	SPRING VALLE	10995.00	102	115
		2	Licensed	CHERRY GROVE	LIME SPRINGS SUB	11075.00	99	155
Minnesota, State of	WQIK561	1	Licensed	Pleasant Grove	Rock Dell	6063.80	89	296
	WQIL437	4	Licensed	Elkton	Leroy	6765.00	21	190
	WQIM310	2	Licensed	Rock Dell	Pleasant Grove	6315.84	96	303
	WQJE438	2	Licensed	Reno	Spring Grove	6855.00	128	577
		3	Licensed	Reno	Caledonia	6795.00	143	252
	WQJE439	3	Licensed	Caledonia	Reno	6635.00	143	252
	WQJF241	3	Licensed	Wykoff	Leroy	6785.00	148	200
	WQJF265	2	Licensed	Spring Grove	Reno	6695.00	127	578
	WQPG709	1	Licensed	Leroy	Wykoff	6625.00	148	201
		3	Licensed	Leroy	Elkton	6605.00	20	190
Mower, County of	WQGV819	2	Licensed	Elkton Tower	Racine	934.18	44	337
		4	Licensed	Elkton Tower	Leroy	934.38	0	396
	WQHF631	1	Licensed	Racine	Elkton	943.18	45	336
	WQHF633	1	Licensed	Leroy	Elkton	943.38	0	396
Townsquare License, LLC	WBS365	1	Licensed	Simpson Repeater	County Road 1 Site	950.00	32	355
	WPOT906	1	Licensed	Preston AM Site	200th Street Site	945.00	358	533
Twin Cities Public Television, Inc.	WPXF844	1	Licensed	New Tower	KSMQ DTV Tower	7100.00	164	300
	WPXM446	1	Licensed	KSMQ DTV Tower	New Tower	6875.00	163	301
	WPXU408	1	Licensed	KSMQ DTV Tower	KSMQ TV Tower	7000.00	183	317
	WQAF486	1	Licensed	Grandmeadow	Simpson	6912.50	97	301

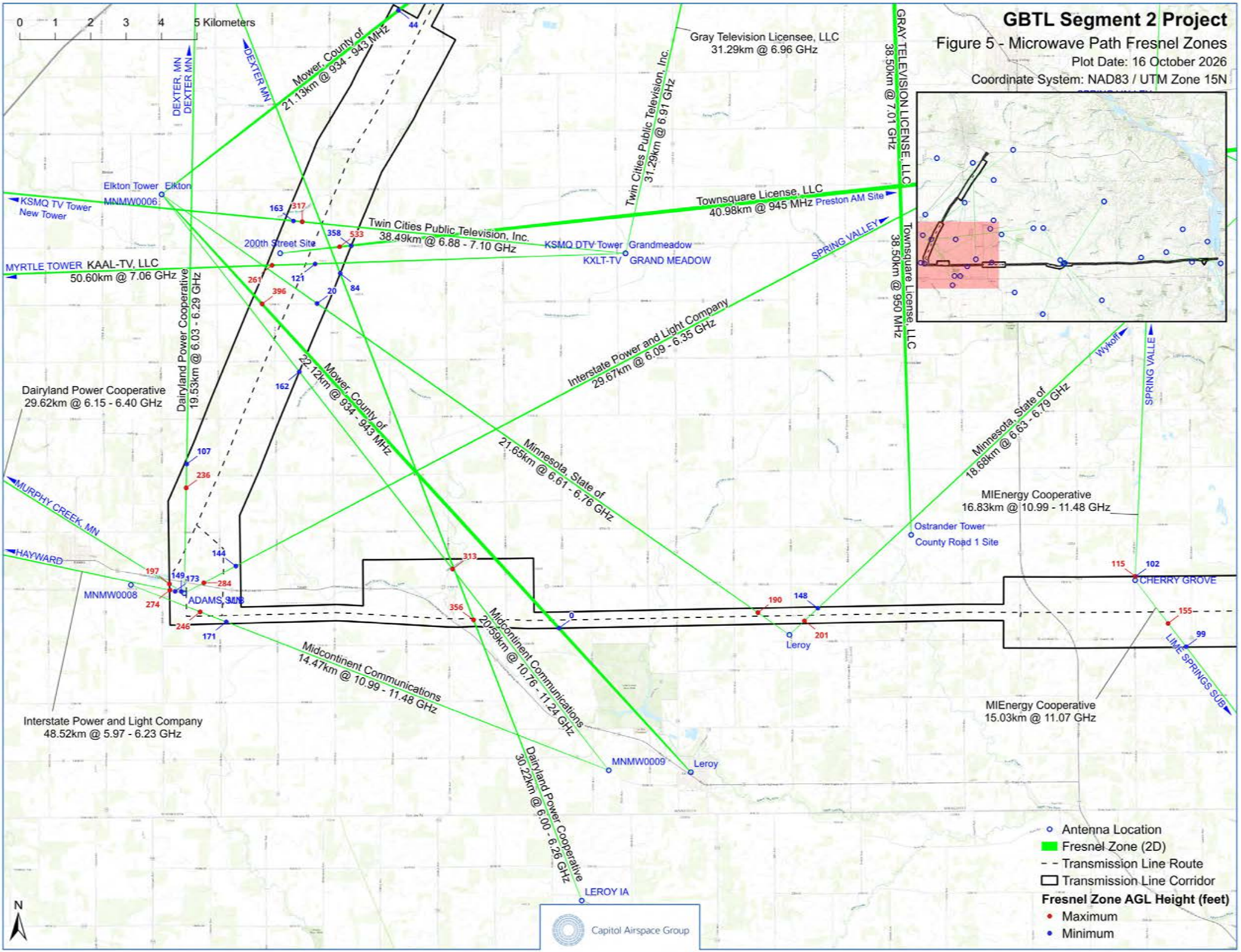
Conclusion

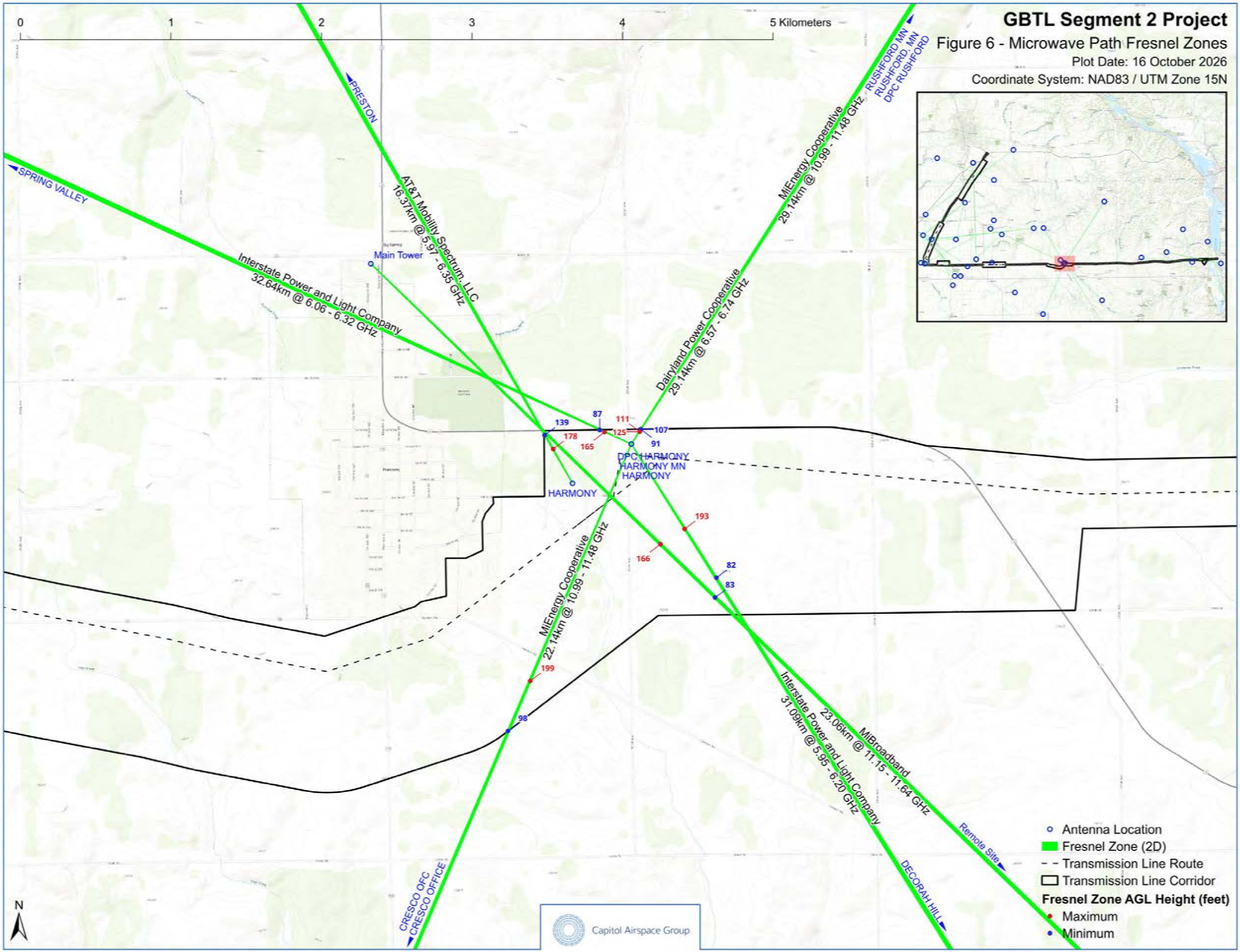
The results of this analysis indicate that 71 paths associated with 33 microwave links overlie the GBTL Segment 2 transmission line project. The associated Fresnel zones (green, ***Figures 4***, ***5***, ***6***, ***7***) cross the study area at heights ranging from surface to 620 feet AGL (blue and red points, ***Figures 4***, ***5***, ***6***, ***7***). Transmission line towers located within the potentially affected Fresnel zones could create a physical obstruction that degrades signal performance and reliability. As a result, the transmission line towers should be sited outside of the two-dimensional Fresnel zones. Alternatively, if towers are located within a two-dimensional Fresnel zone, they should be lower than the potentially affected link's Fresnel zone minimum AGL height (see "Min" column ***Table 1*** or blue points, ***Figures 4***, ***5***, ***6***, ***7***).

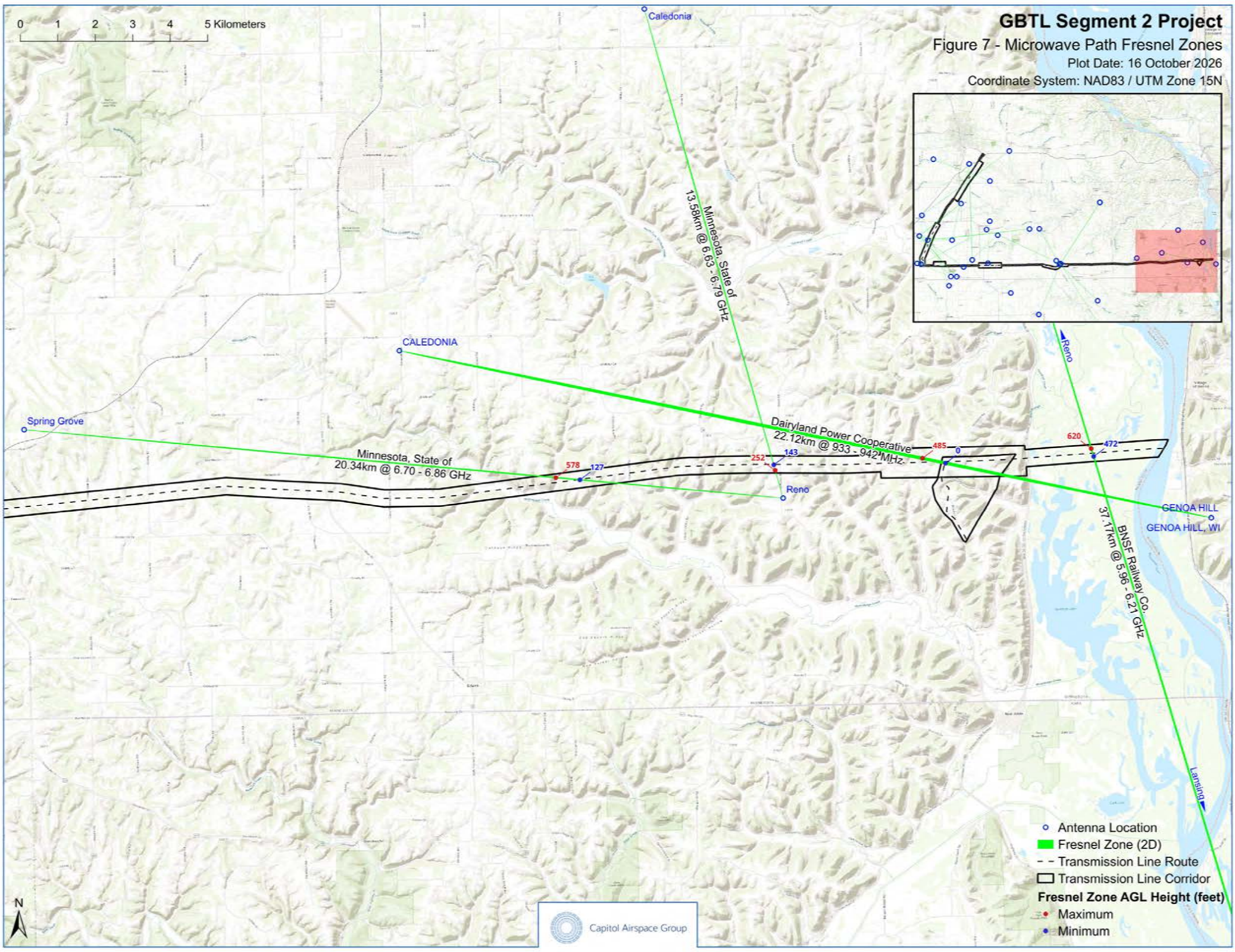
Additionally, catenary wires could also interfere with microwave links depending on tower placement and wire sag. Additional three-dimensional analysis would be required to determine if catenary wires intersect the Fresnel zones. If they do, signal degradation could occur depending on the microwave system characteristics. These characteristics include, but are not limited to, path frequency, antenna polarization, and modulation scheme.

If you have any questions regarding the findings of this study, please contact ***David Beranek*** or ***Candace Childress*** at (703) 256-2485.


0 1 2 3 4 5 Kilometers
GBTL Segment 2 Project
Figure 4 - Microwave Path Fresnel Zones
Plot Date: 16 October 2026
Coordinate System: NAD83 / UTM Zone 15N
Rock Dell
Simpson Tower
Simpson Twr
Simpson Repeater
Simpson
Minnesota, State of
24.26km @ 6.06 - 6.32 GHz
EYOTA MN
303
355
302
89
131
32
301
302
59
Pleasant Grove
340
Dairyland Power Cooperative
43.46km @ 6.06 - 6.32 GHz
98
97
Gray Television Licensee, LLC
31.29km @ 6.96 GHz
Townsquare License, LLC GRAY TELEVISION LICENSE, LLC
38.50km @ 950 MHz
38.50km @ 7.01 GHz
Racine
DEXTER MN
DEXTER, MN
Mower, County of
21.13km @ 934 - 943 MHz
337
Twin Cities Public Television, Inc.
31.29km @ 6.91 GHz
KXLT-TV
Grandmeadow
Ostrander Tower
County Road 1 Site
44
Elkton Tower
Elkton
SPRING VALLE
N
Capitol Airspace Group
Antenna Location
Fresnel Zone (2D)
Transmission Line Route
Transmission Line Corridor
Fresnel Zone AGL Height (feet)
Maximum
Minimum


GBTL Segment 2 Project
Figure 5 - Microwave Path Fresnel Zones
Plot Date: 16 October 2026
Coordinate System: NAD83 / UTM Zone 15N
0 1 2 3 4 5 Kilometers
Gray Television Licensee, LLC
31.29km @ 6.96 GHz
GRAY TELEVISION LICENSE, LLC
38.50km @ 7.01 GHz
Twin Cities Public Television, Inc.
31.29km @ 6.91 GHz
Mower County of
21.13km @ 934 - 943 MHz
DEXTER, MN
DEXTER MN
DEXTER MN
Elkton Tower Elkton
MNMW0006
KSMQ TV Tower
New Tower
Townsquare License, LLC
40.98km @ 945 MHz Preston AM Site
Twin Cities Public Television, Inc.
38.49km @ 6.88 - 7.10 GHz
200th Street Site
KSMQ DTV Tower Grandmeadow
KXLT-TV GRAND MEADOW
SPRING VALLEY
Townsquare License, LLC
38.50km @ 950 MHz
MYRTLE TOWER KAAL-TV, LLC
50.60km @ 7.06 GHz
Dairyland Power Cooperative
19.53km @ 6.03 - 6.29 GHz
Interstate Power and Light Company
29.67km @ 6.09 - 6.35 GHz
Mower, County of
22.12km @ 934 - 943 MHz
Dairyland Power Cooperative
29.62km @ 6.15 - 6.40 GHz
Minnesota, State of
21.65km @ 6.61 - 6.76 GHz
Minnesota, State of
18.68km @ 6.63 - 6.79 GHz
Wykoff
SPRING VALLE
MIEnergy Cooperative
16.83km @ 10.99 - 11.48 GHz
Ostrander Tower
County Road 1 Site
MURPHY CREEK, MN
HAYWARD
MNMW0008
ADAMS, MN
CHERRY GROVE
Midcontinent Communications
20.59km @ 10.76 - 11.24 GHz
Leroy
Midcontinent Communications
14.47km @ 10.99 - 11.48 GHz
Interstate Power and Light Company
48.52km @ 5.97 - 6.23 GHz
MIEnergy Cooperative
15.03km @ 11.07 GHz
LIME SPRINGS SUB
MNMW0009
Leroy
Dairyland Power Cooperative
30.22km @ 6.00 - 6.26 GHz
LEROY IA
N
Capitol Airspace Group
Antenna Location
Fresnel Zone (2D)
Transmission Line Route
Transmission Line Corridor
Fresnel Zone AGL Height (feet)
Maximum
Minimum


GBTL Segment 2 Project
Figure 6 - Microwave Path Fresnel Zones
Plot Date: 16 October 2026
Coordinate System: NAD83 / UTM Zone 15N
0
1
2
3
4
5 Kilometers
PRESTON
SPRING VALLEY
RUSHFORD MN
RUSHFORD, MN
DPC RUSHFORD
AT&T Mobility Spectrum, LLC
16.37km @ 5.97 - 6.35 GHz
MiEnergy Cooperative
29.14km @ 10.99 - 11.48 GHz
Interstate Power and Light Company
32.64km @ 6.06 - 6.32 GHz
Dairyland Power Cooperative
29.14km @ 6.57 - 6.74 GHz
Main Tower
87
111
139
125
107
178
165
91
DPC HARMONY
HARMONY MN
HARMONY
193
166
82
83
MiEnergy Cooperative
22.14km @ 10.99 - 11.48 GHz
199
98
Interstate Power and Light Company
31.09km @ 5.95 - 6.20 GHz
MiBroadband
23.06km @ 11.15 - 11.64 GHz
Remote Site
DECORAH HILL
CRESCO OFC
CRESCO OFFICE
N
Capitol Airspace Group
Antenna Location
Fresnel Zone (2D)
Transmission Line Route
Transmission Line Corridor
Fresnel Zone AGL Height (feet)
Maximum
Minimum


0 1 2 3 4 5 Kilometers
GBTL Segment 2 Project
Figure 7 - Microwave Path Fresnel Zones
Plot Date: 16 October 2026
Coordinate System: NAD83 / UTM Zone 15N
Caledonia
Minnesota, State of
13.58km @ 6.63 - 6.79 GHz
CALEDONIA
Spring Grove
Minnesota, State of
20.34km @ 6.70 - 6.86 GHz
578
127
252
143
Reno
Dairyland Power Cooperative
22.12km @ 933 - 942MHz
485
0
620
472
Reno
GENOA HILL
GENOA HILL, WI
BNSF Railway Co.
37.17km @ 5.96 - 6.21 GHz
Lansing
N
Capitol Airspace Group
Antenna Location
Fresnel Zone (2D)
Transmission Line Route
Transmission Line Corridor
Fresnel Zone AGL Height (feet)
Maximum
Minimum