

CONSOLIDATED TECHNICAL STATEMENT

prepared August 2023 for

Lutheran Church - Missouri Synod

KXFN(AM) St. Louis, Missouri

Introduction

Lutheran Church - Missouri Synod (“LCMS”) is the licensee of Class B Station KXFN(AM), 1380 kHz, located in St. Louis, Missouri¹. The present KXFN facility operates as a “two-site” or “split-site” operation: The present daytime site is located at Chouteau Island, Illinois while the existing nighttime site is near East Carondelet, Illinois. The present daytime operation employs a three-tower directional array with a transmitter power of 5 kW. The separate nighttime operation² employs a four-tower directional array with a transmitter power of 1 kW.

LCMS is herein seeking authority to relocate the KXFN day operation to its nighttime transmitting site. The proposed new daytime power level for KXFN is 2 kW. (Authority will be separately sought in a later filing to license the daytime site as an auxiliary site.) A slight coordinate correction for the licensed night array is also being requested along with a minor correction in the electrical tower height. This application proposal may be considered to be a “minor change” under FCC Rule Section 73.3571(a)(2).

Proposed New Location for the KXFN Daytime Operation

The proposed consolidated Day/Night location is shown in the *Google Earth*TM image provided below.



¹ FCC Facility ID 74579, FCC File No. BML-20201013AEO

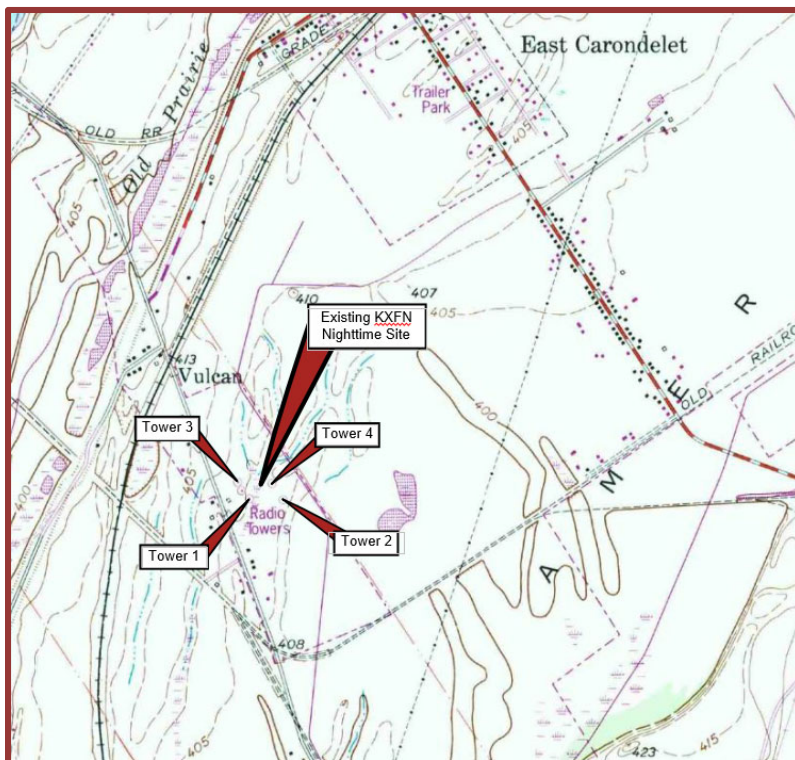
² Co-owned KFUE is authorized under FCC Construction Permit (CP) number BP-20220926AAC to relocate its non-directional operation to one of the existing towers at the KXFN nighttime site.

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A copy of a portion of the U.S.G.S. Cahokia Illinois – Missouri 7.5 minute quadrangle map is provided below showing the location of the long established nighttime site near East Carondelet, Illinois.



The coordinates for the array center for the proposed KXFN nighttime operation are as follows:

Coordinates in NAD-83 Datum

38° 31' 26.0" North Latitude
90° 14' 17.8" West Longitude

Coordinates in NAD-27 Datum

38° 31' 25.8" North Latitude
90° 14' 17.4" West Longitude

The coordinates for the licensed KXFN night site differ by 1.2 seconds in latitude and 0.4 seconds in longitude from the reevaluated array center coordinates shown above. A minor coordinate correction for the licensed night array is being concurrently requested in this application³.

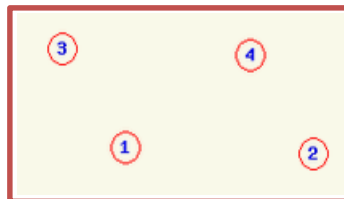
The FCC Antenna Structure Registration⁴ ("ASR") Numbers for the four existing KXFN nighttime towers are:

Tower 1 (SW): 1006874

Tower 2 (SE): 1006875

Tower 3 (NW): 1006876

Tower 4 (NE): 1006877



³ A correction of this magnitude is usually handled through a modification of license application (Form 302) per FCC Rule Section 73.1690(c)(11). It is being requested herein to allow the harmonization of all data for this station in one filing.

⁴Minor discrepancies have been noted in the underlying information for the above registrations; the FAA has been advised accordingly via 7460-1 filings. Corrections to the FCC ASR records will be made pending receipt of updated FAA reviews.

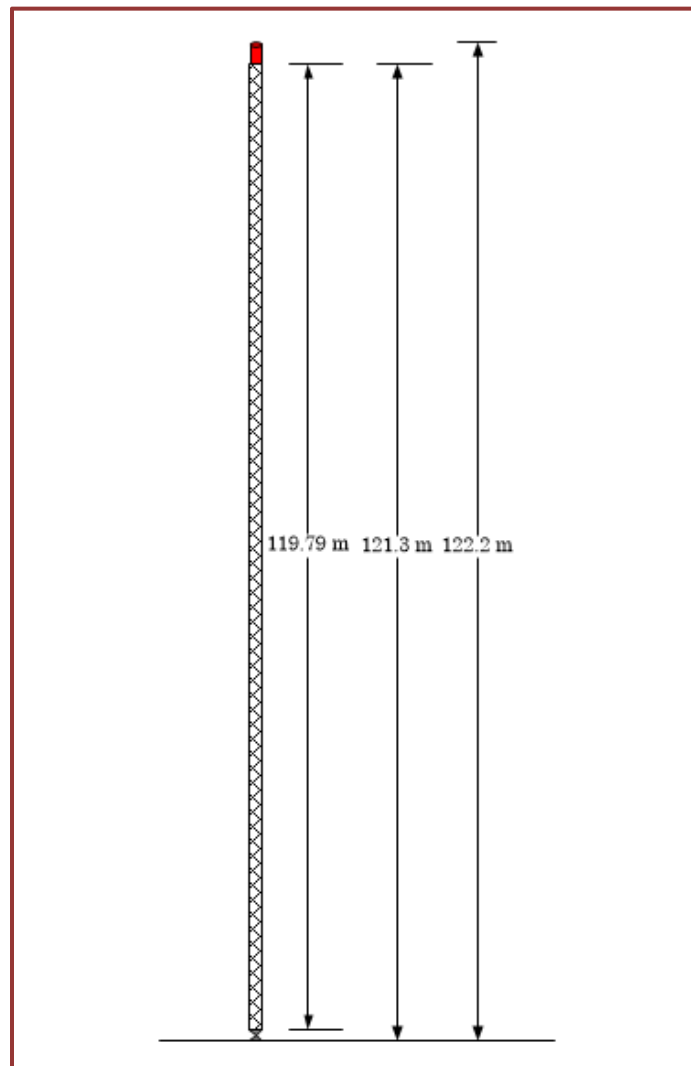
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Antenna Description

It is proposed to use the four existing KXFN night site tower structures for the KXFN daytime array. Each tower is base-insulated (series fed), and is uniform cross-section and guyed. As shown below, the overall heights of all of the towers are 122.2 meters above ground level. No changes are being proposed for these structures. The radiating portion of each tower is 119.79 meters in length, yielding an electrical height of 198.5 degrees⁵ at 1380 kHz.



⁵ The KXFN (formerly KWK) October 1978 Nighttime *Application for License* and the subsequently issued license (BL-19781024AC) lists the tower heights as being 393 feet above the base insulators, which converts to 119.79 meters. This structure height value also agrees with early construction documents. This length equates to 198.5 electrical degrees at 1380 kHz. However, the old FCC filings and licenses show the tower electrical height as being 200 degrees, presumably because of rounding. We request that the record for the station be updated to the correct value of 198.5°. This paperwork correction results in a de minimis “change” in nighttime margin toward other stations (a 0.4% change or less). Further, no physical changes have been made to the height of these existing towers since their construction in 1978, nor are any being proposed. (If the 1 meter beacon is included in the height, as is sometimes done, the electrical height would be 200°.) Nevertheless, if a waiver of FCC Rule Section 73.182 is believed to be necessary, it is herein respectfully requested on behalf of LCMS.

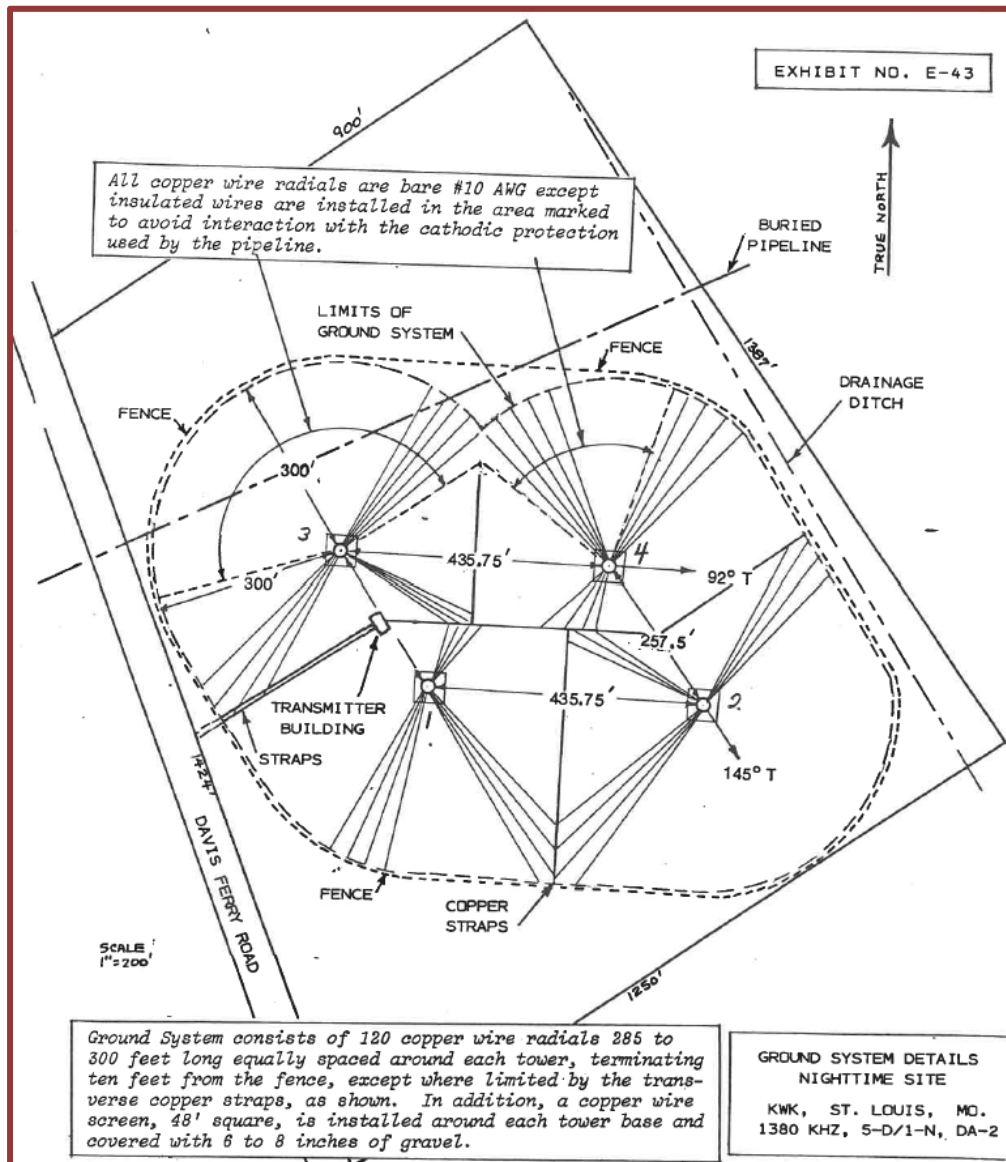
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Ground System Description – Transmitter Power – Antenna System

The ground system presently installed at this site, as described below in the KXFN (formerly KWK) October 1978 Nighttime Application for License (and subsequently issued License – BL-19781024AC) consists of 120 copper wire radials 86.9 to 91.4 meters long equally spaced around each tower, terminating 3 meters from the site fence boundary, except where limited by the transverse copper straps. A copper wire screen, 14.6 meters square, is installed around each tower base. There will be no changes to this existing ground system.



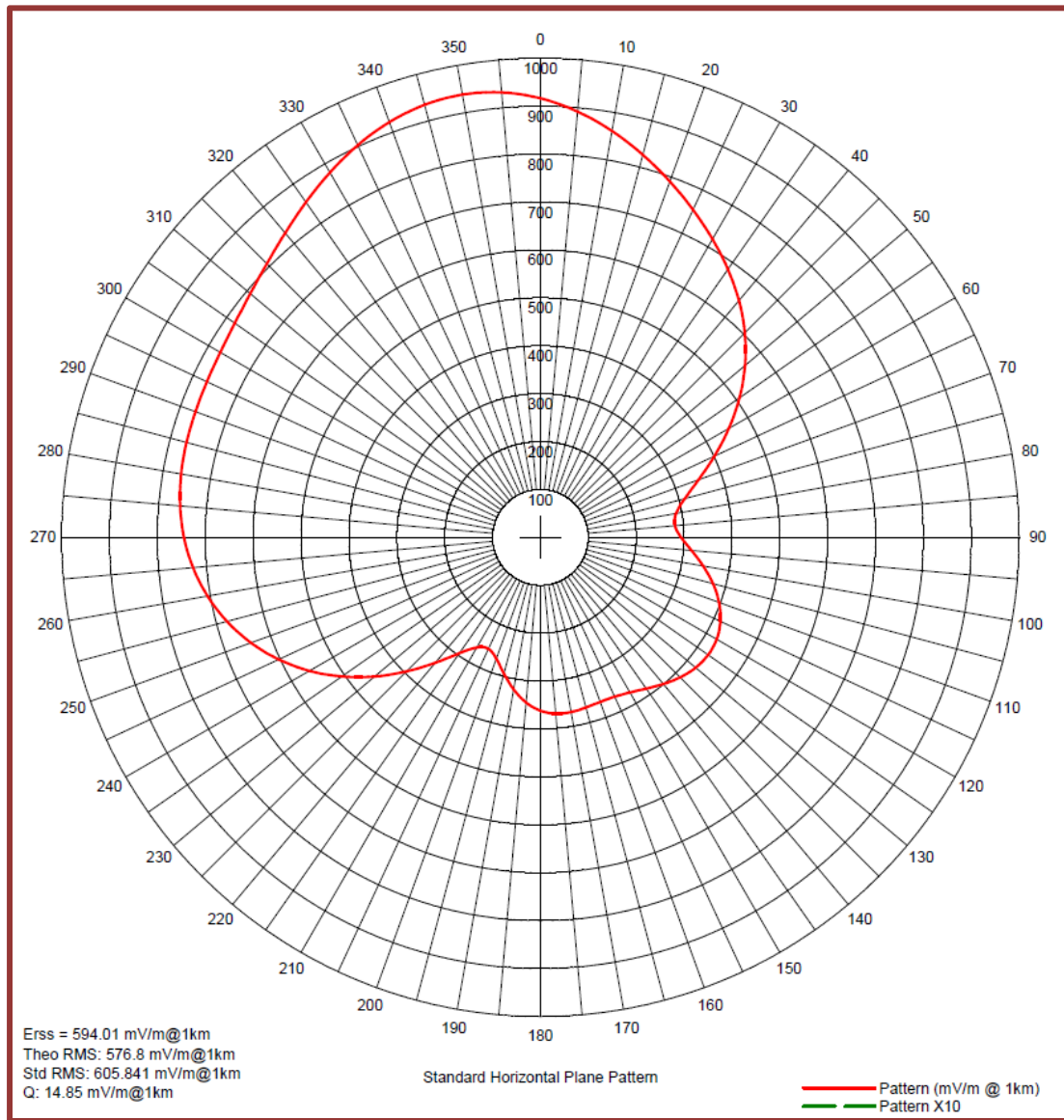
A transmitter power of 2 kW is being specified herein. The theoretical antenna efficiency for the proposed daytime operation will be 576.8 mV/m at 1 km. The Standard RMS will be 605.841 mV/m at 1 km. A horizontal plane polar graph and summary of the proposed directional antenna pattern are provided on the next page.

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Proposed New Daytime Antenna Pattern



Tower Number	Field Ratio	Phase (deg)	Spacing (deg)	Orient (deg)	Height (deg)	Ref Switch	TL Switch	A (deg)	B (deg)	C (deg)	D (deg)
1	1.000	0.0	0	0	198.5	0	0	0	0	0	0
2	0.100	85.1	220	92	198.5	0	0	0	0	0	0
3	0.598	-113.1	130	325	198.5	0	0	0	0	0	0
4	0.110	-104.7	220	92	198.5	1	0	0	0	0	0

Note: Tower 4 spacing and orientation is with respect to Tower 3

Theoretical RMS: 576.8 mV/m@1km Erss = 594.01 mV/m@1km Power: 2 kW

Standard RMS: 605.841 mV/m@1km Q = 14.85 mV/m@1km

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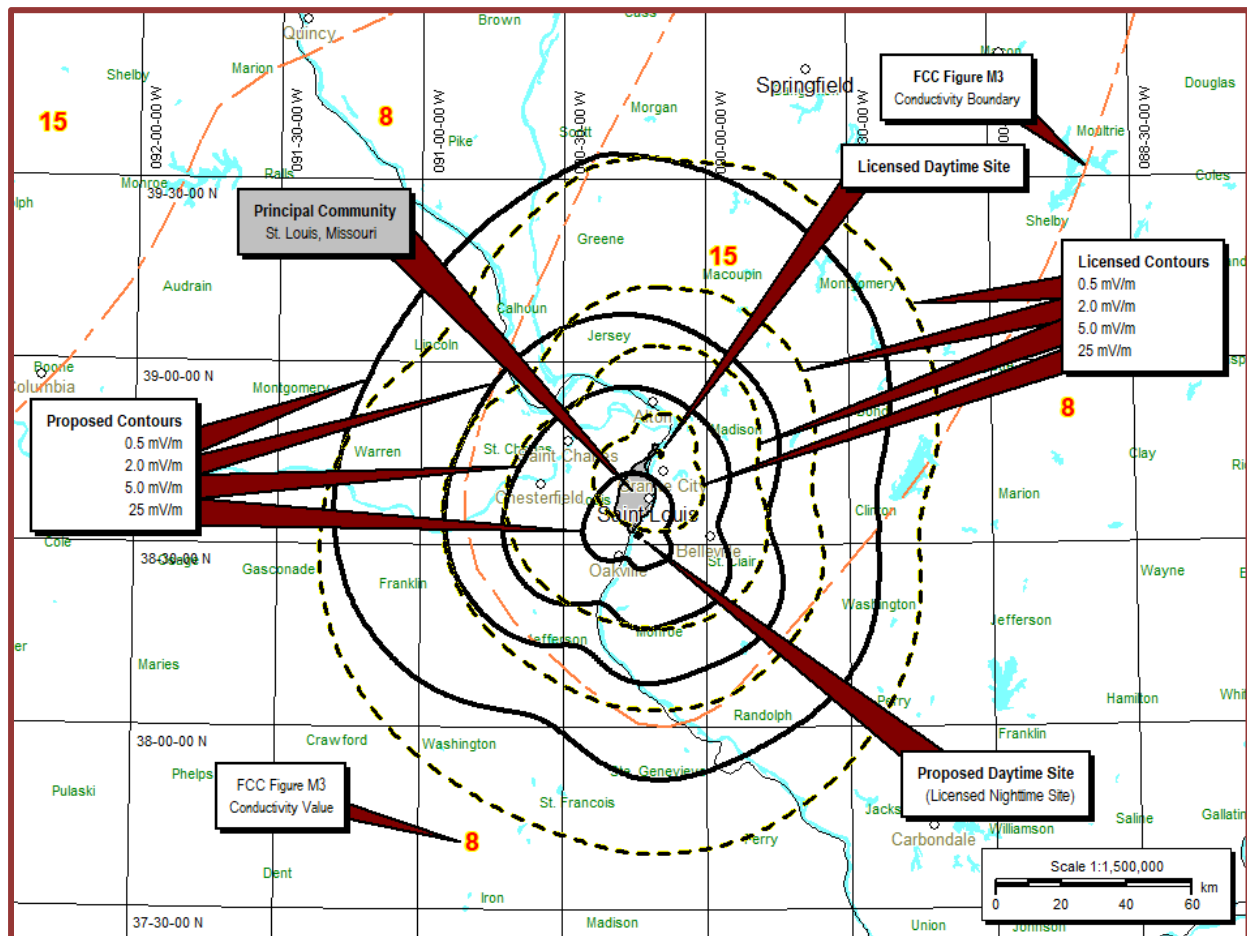
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Predicted Coverage

All contours used in this application were predicted in accordance with the methods specified in the FCC's Rules. In this application, one degree radial intervals were used for all contour predictions. Theoretical FCC Figure M-3 ground conductivity data⁶ were employed as the prediction basis.

The following map shows the locations of the predicted existing and proposed pertinent contours (0.5, 2, 5, and 25 mV/m) for the station. A detailed view of principal community coverage is provided in a following map. Similarly, the predicted 1 V/m (1000 mV/m) "blanketing" contour will be shown along with a summary of the population encompassed by that contour. The customary 0.5, 0.025, 0.25, 5 and 25 mV/m "allocation study" contours are shown in the pertinent allocation maps which follow. In the map shown immediately below, the dashed, highlighted contours are the licensed KXFN contours, while the solid contours are the proposed contours.

Predicted Licensed and Proposed Daytime 0.5, 2, 5, and 25 mV/m Contours



⁶ FCC Staff has informally agreed that, due to the lack of available measured conductivity data for the surrounding stations, use of KXFN measured data would not be necessary for this particular proposal. In general, the measured contours do not extend beyond the theoretical contours. Nevertheless, this data can be provided and incorporated into contour showings upon request.

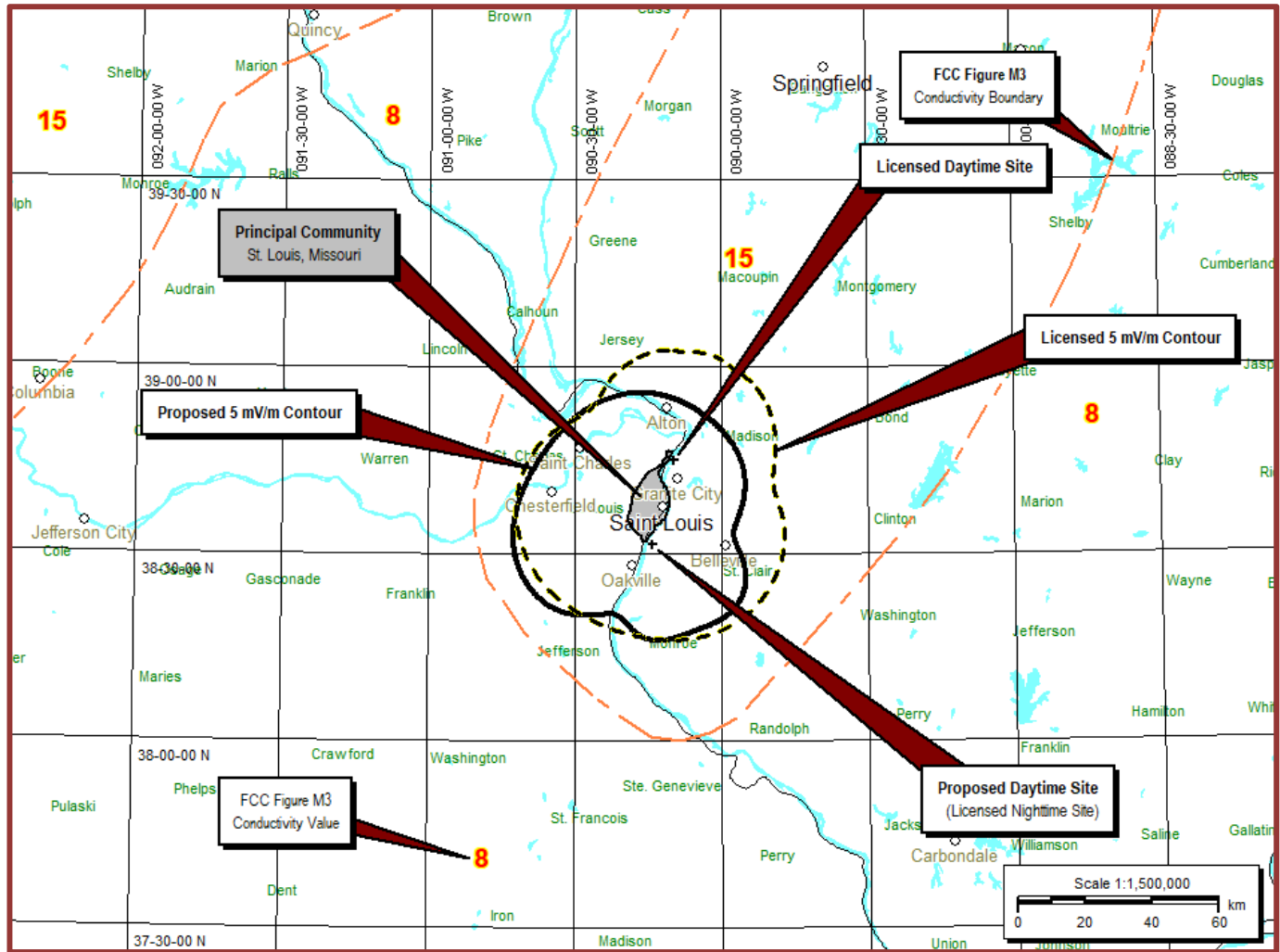
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Principal Community Coverage

The proposed 5 mV/m principal community coverage contour encompasses 100 percent of the KXFN community of license, St. Louis, Missouri, as shown below. This application thus satisfies the principal community coverage requirements of FCC Rule Section 73.24(i) for modifications of existing licensed stations.



Blanketing Contours

The locations of the licensed and proposed 1 V/m (1000 mV/m) “blanketing” contours were predicted in accordance with the FCC’s Rules. Using U.S. 2020 Census data, it is estimated that there are 638,562 persons residing within the proposed 25 mV/m contour, and 32 *persons* residing within the proposed 1 V/m blanketing contour. Since the number of persons within the predicted 1 V/m contour is fewer than 300, the provisions of FCC Rule Section 73.24(g) are not applicable. The proposed modified KXFN operation thus meets the requirements of the FCC’s Rules regarding 1 V/m blanketing interference. The locations of the existing and proposed 1 V/m “Blanketing” Contours are shown in the following maps.

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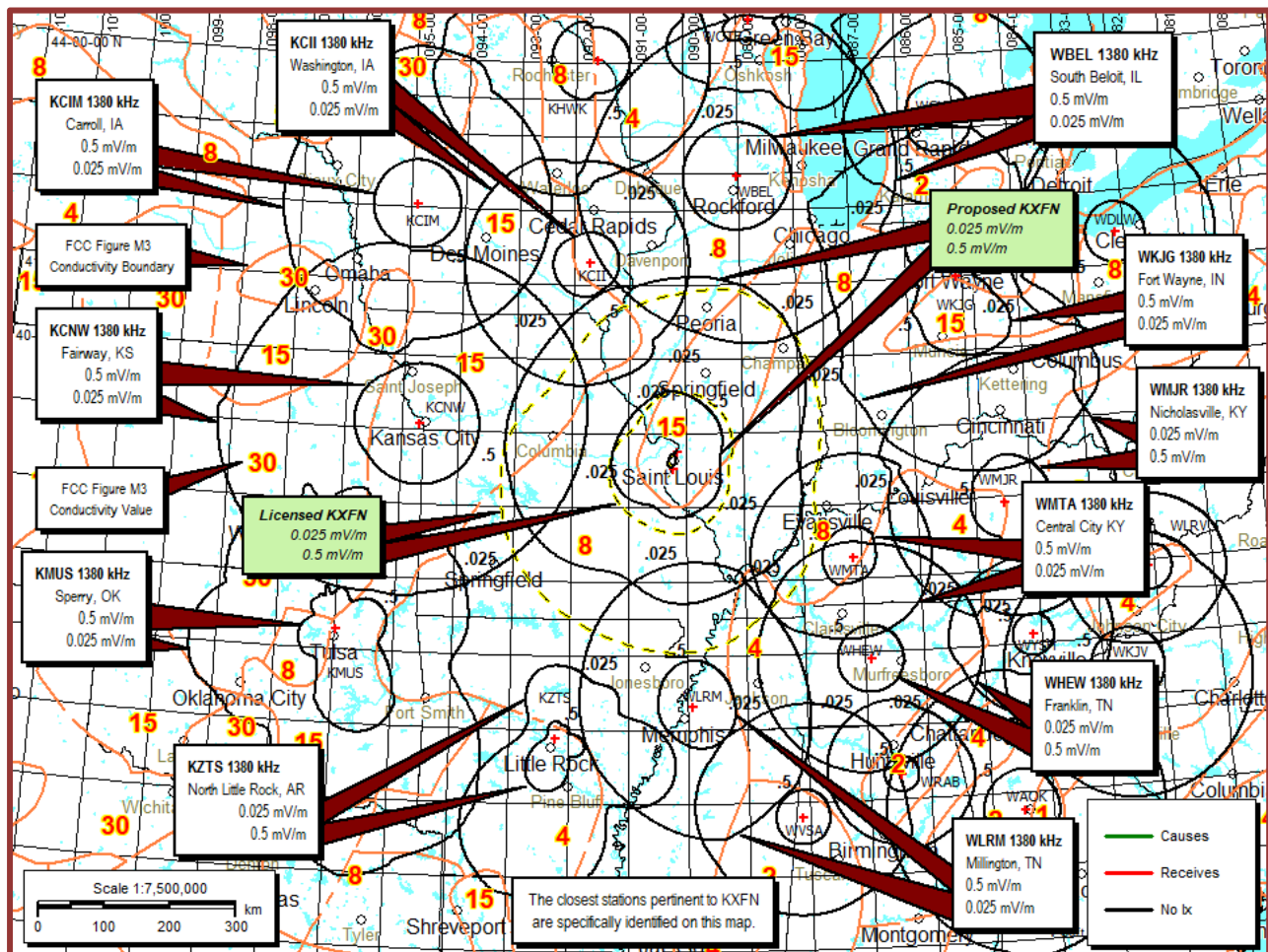
Frequency Usage and Allocation Considerations – Cochannel and Adjacent Channel Stations

This proposal was evaluated for compliance with the FCC's daytime frequency usage and channel allocations rules. Based upon this analysis, and as demonstrated herein, it is believed that all pertinent FCC interference rules and policies would continue to be satisfied after a grant of this application.

For ease of understanding, contour color coding is used in the following maps. The presently licensed KXFN contours are shown as dashed, yellow highlighted lines while all other station contours (including those of the proposed facility) are plotted with solid lines. Where instances of prohibited contour overlap occur, green contours indicate *overlap caused* while red contours indicate *overlap received*. Black contours indicate no prohibited contour overlap exists or is caused. In instances where overlaps may be difficult to visually evaluate from the maps, the extent of overlap (in terms of comparative area in square kilometers) is provided in tabular form.

A map summarizing the co-channel allocations picture is provided below. As shown, no new prohibited contour overlap is created; instances of existing contour overlap are reduced.

Co-Channel Allocation Study



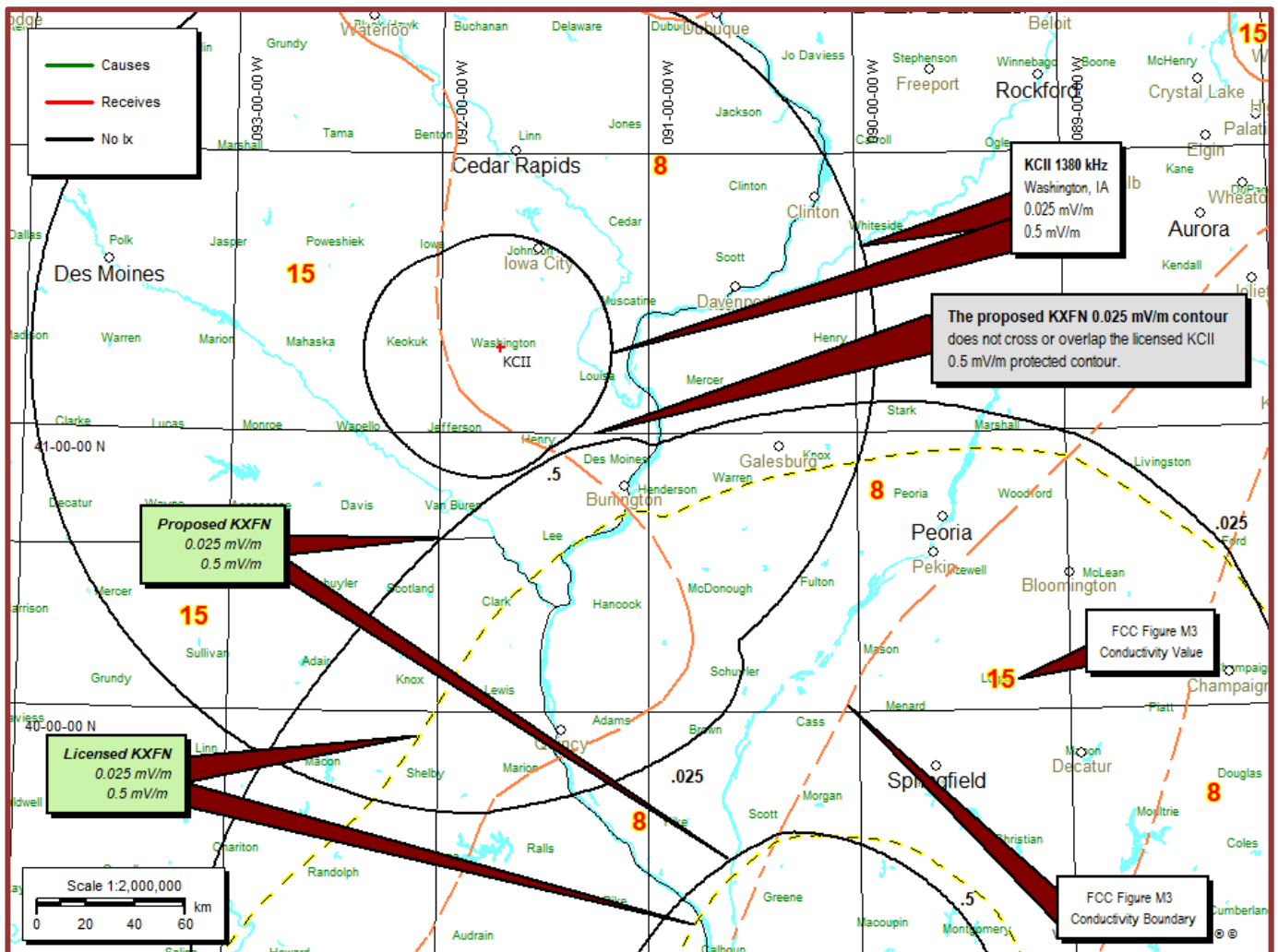
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While the preceding map provided an overall look at the cochannel frequency usage and allocations picture, one cochannel situation was a bit difficult to clearly see due to the map scale; specifically the location of the licensed and proposed KXFN 0.025 mV/m contours with respect to the protected 0.5 mV/m contour of KCII, Washington, Iowa. The following map presents a closer, detailed view of the contour separation between the KCII protected contour, and the licensed and proposed KXFN interfering contours. As shown, no prohibited contour overlap will be created with respect to KCII upon a grant of this application.

Co-Channel Allocation Study – Detailed View - Proposed KXFN versus KCII



As demonstrated above, neither the licensed nor the proposed KXFN 0.025 mV/m contour crosses the KCII protected 0.5 mV/m contour. The preceding pair of maps thus demonstrates that no new instances of co-channel prohibited contour overlap would be created by the proposed relocation of KXFN. It is thus believed that this proposal meets the FCC's allocation requirements for co-channel stations.

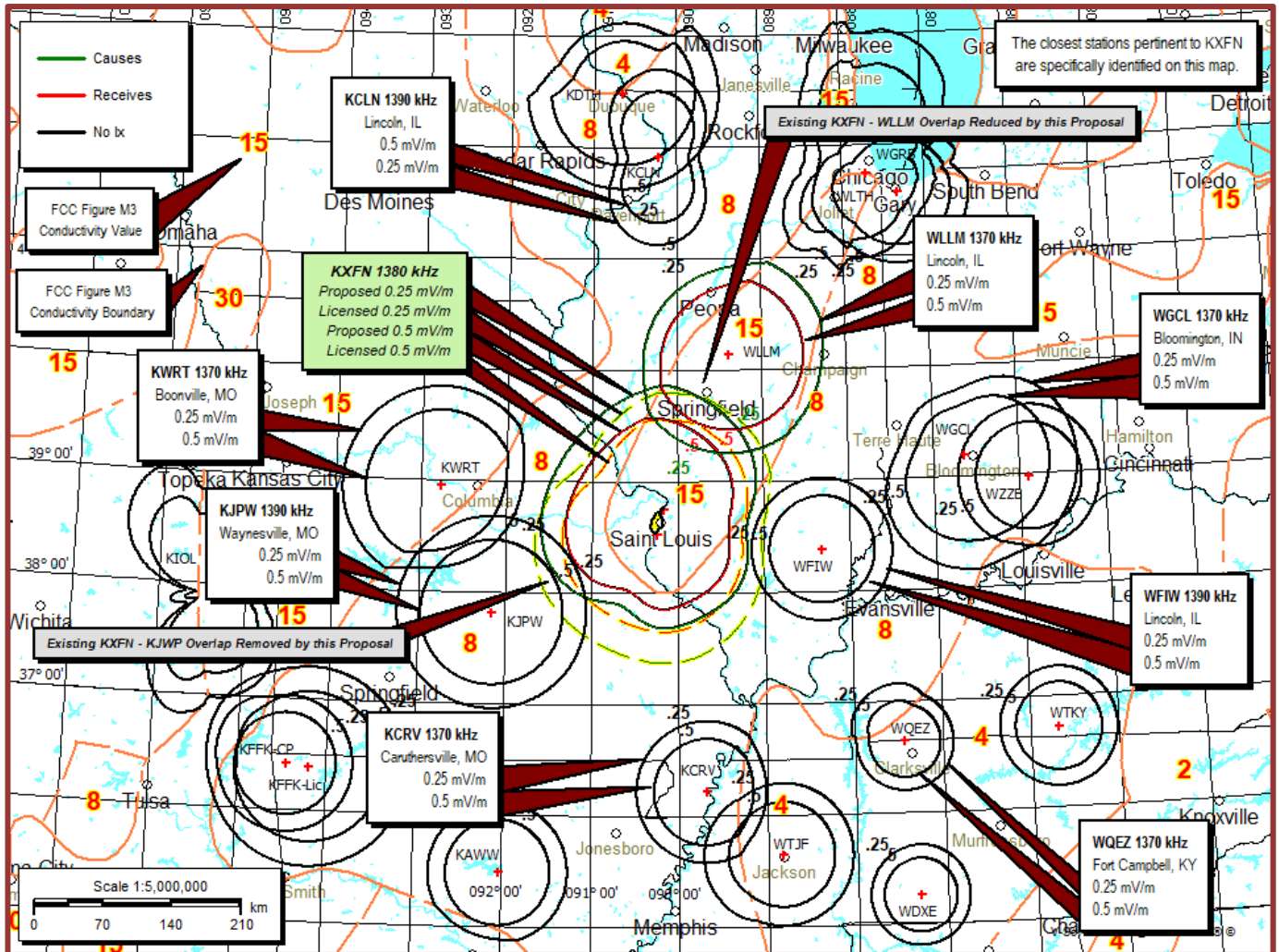
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A map summarizing the overall first-adjacent channel allocations picture is provided below. As will be shown, *no new prohibited contour overlap would be caused* under this minor change proposal. Additionally, one instance of existing contour overlap *would be reduced while another would be completely eliminated*.

First-Adjacent Channel Allocation Study - Overview Map



As shown above, the only first-adjacent channel situations that merit closer scrutiny are those with respect to WLLM (1370 kHz, Lincoln, Illinois), and KJPW (1390 kHz, Waynesville, Missouri), where there is *existing* contour overlap with the licensed daytime KXFN operation.

Specifically, the presently licensed KXFN 0.25 mV/m contour is predicted to overlap the existing WLLM protected 0.5 mV/m contour while the existing WLLM 0.25 mV/m contour is predicted to overlap the licensed KXFN 0.5 mV/m contour. However, as is shown on the following map, the amount of contour overlap between WLLM and KXFN will be *reduced* under this proposal. Additionally, the mutual caused and received prohibited contour overlap with KJPW would be *eliminated* upon a grant of this application.

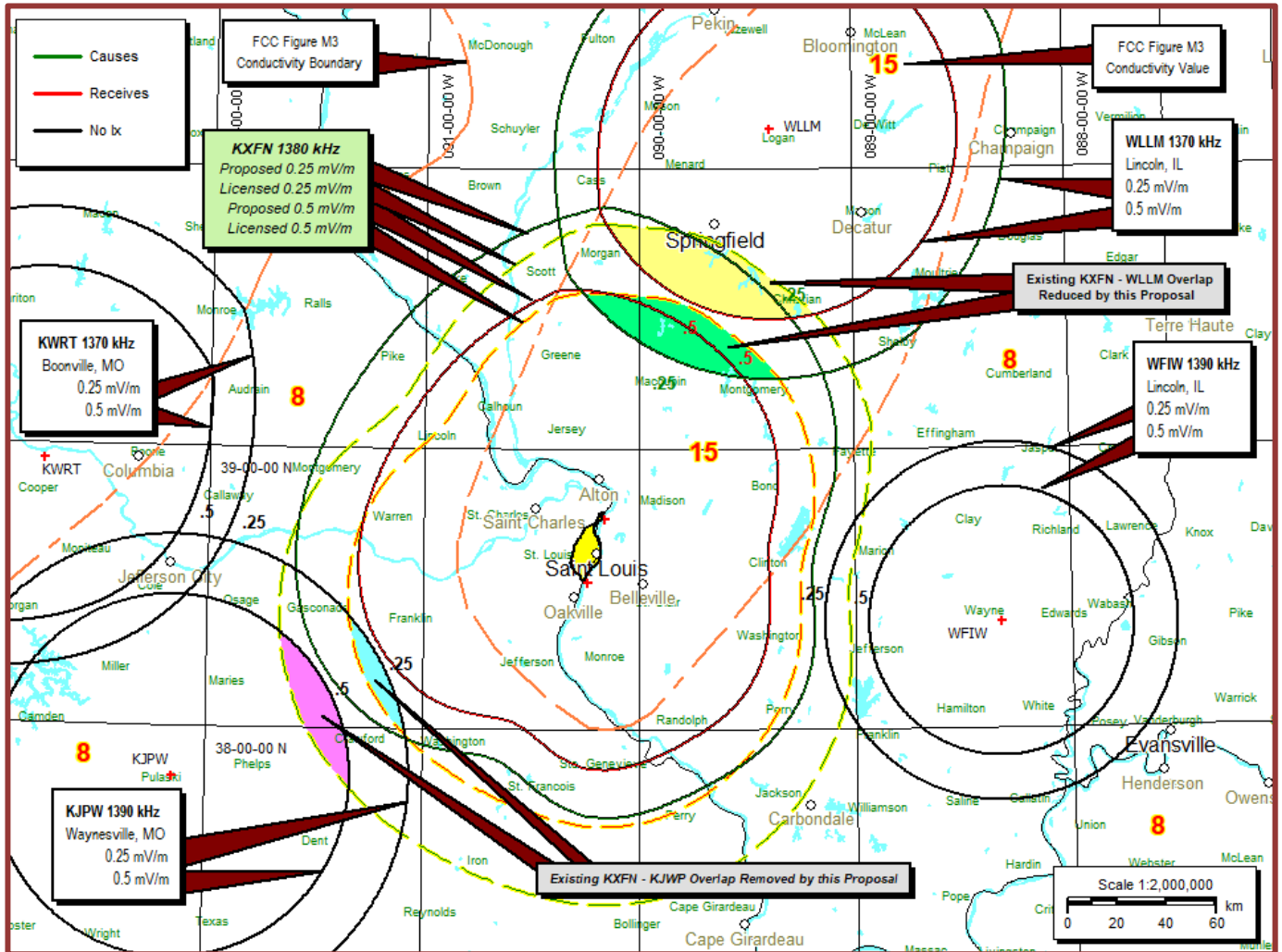
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First-Adjacent Channel Allocation Study – Detailed View

Licensed and proposed KXFN contours with respect to existing WLLM and KJPW contours



The above map more clearly illustrates the first adjacent “before” versus “after” contour overlap picture and the relief that would be afforded by this proposal. However, since the magnitude of 0.5 mV/m overlap toward WLLM is more difficult to quantify visually, the following summary table is included to show the differences. (Red font indicates a contour overlap instance; black font represents an absence of overlap.)

Call <u>Sign</u>	Freq <u>(kHz)</u>	Location <u>City - State</u>	<u>Licensed Contour Overlap</u>		<u>Contour Overlap as Proposed</u>	
			<u>Incoming</u>	<u>Outgoing</u>	<u>Incoming</u>	<u>Outgoing</u>
WLLM	1370	Lincoln, IL	-1206.25 sq. km	-1528.25 sq. km	-729.75 sq. km	-1395.50 sq. km
KJPW	1390	Waynesville, MO	-302.25 sq. km	-682.25 sq. km	4.62 sq. km	5.16 sq. km

As demonstrated in the preceding two maps and the above tabulation, no new instances of prohibited contour overlap would be caused by a grant of this modification proposal; instances of existing contour overlap would be reduced or eliminated. This proposal meets the FCC’s rule requirements for first-adjacent channel stations.

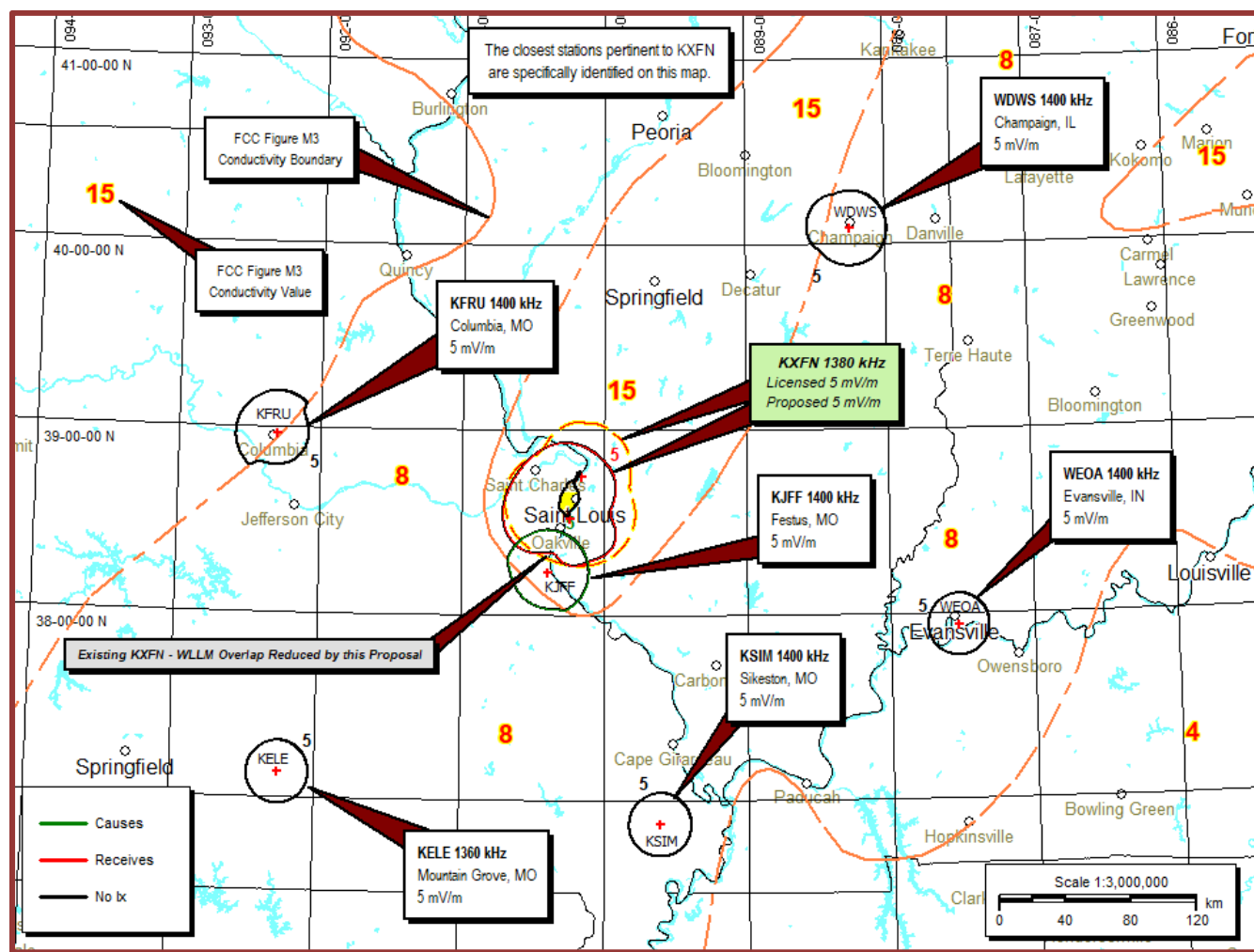
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The following provides an overview of the *second-adjacent* allocation situation in the vicinity of KXFN.

Second-Adjacent Channel Allocation Study



As shown above, the stations on frequencies that are second adjacent to KXFN are spaced far enough away as to not be of any concern, with the exception of KJFF, 1400 kHz, in Festus, Missouri, where existing prohibited contour overlap exists. However, the amount of contour overlap between KJFF and KXFN would be *reduced* under this proposal. Since the amount of overlap reduction is difficult to visualize in the above, the following table is included to demonstrate the overlap area reduction (in terms of area in square kilometers).

Call Sign	Freq (kHz)	Location City - State	Licensed Contour Overlap		Contour Overlap as Proposed	
			Incoming	Outgoing	Incoming	Outgoing
KJFF	1400	Festus, MO	-546.00 sq. km	-546.00 sq. km	-514.50 sq. km	-514.50 sq. km

Since no new instances of prohibited contour overlap would be caused by a grant of this modification proposal, and an instance of existing contour overlap will be reduced, it is believed that this proposal meets the FCC's rule requirements for second-adjacent channel stations.

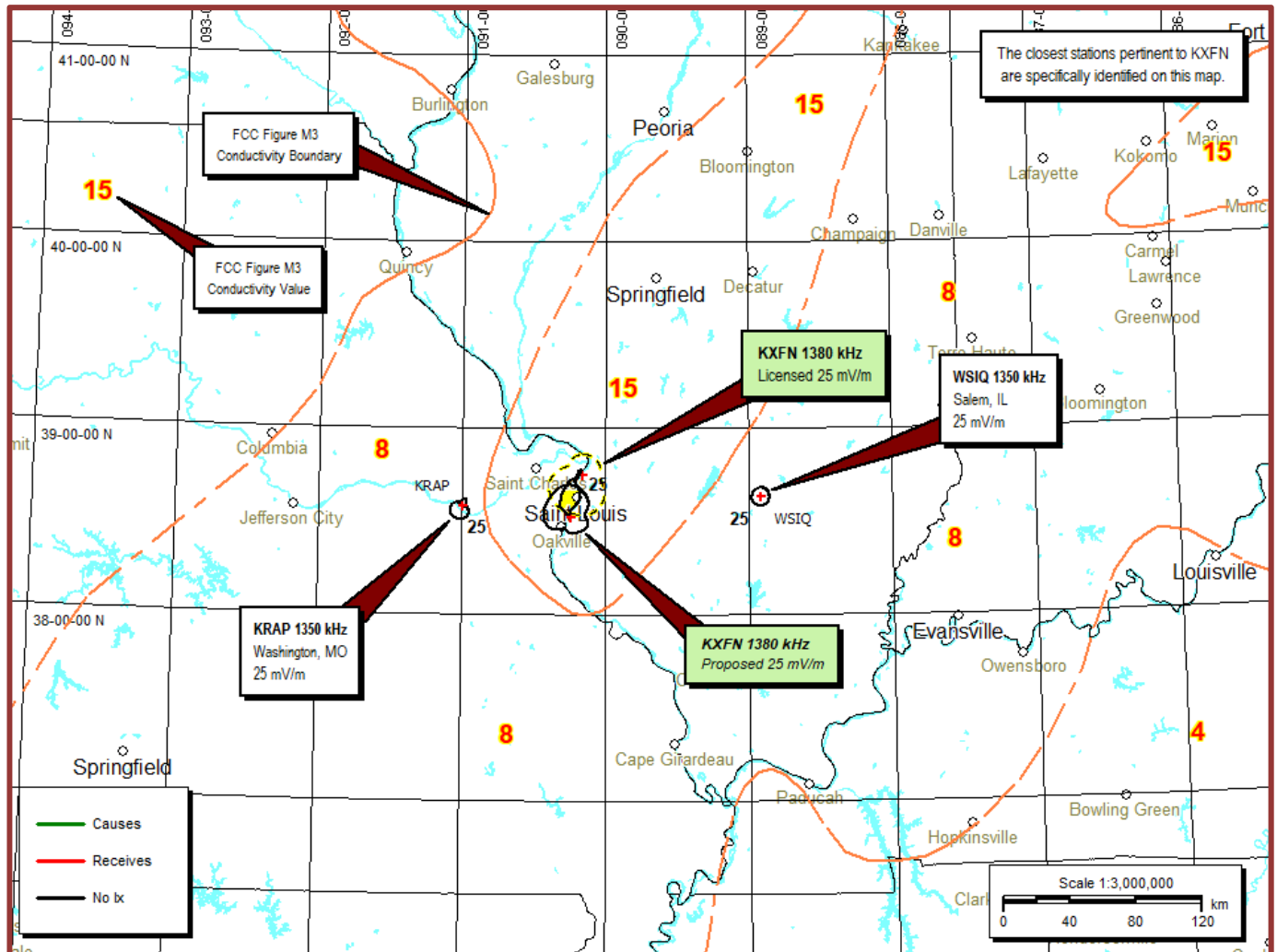
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The following map provides an overview of the *third-adjacent* allocation situation in the vicinity of KXFN.

Third-Adjacent Channel Allocation Study



Based upon the above allocation study, no new instances of third-adjacent channel prohibited contour overlap will be created by a grant of this application. It is therefore believed that this proposal meets the FCC's daytime allocations requirements with respect to stations on third-adjacent frequencies.

Summary of Daytime Allocations Study

As demonstrated in the foregoing, no new instances of daytime contour overlap will be created if this facility relocation application were granted. Further, instances of existing contour overlap would be either reduced or eliminated. It is thus believed that a grant of this proposal would be in the public interest.

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Monitoring Stations, Quiet Zones, Borders

The nearest FCC monitoring station is at Allegan, Michigan at a distance of over 500 km from the proposed new KXFN day site. This exceeds by a significant margin the minimum distance specified in §73.1030(c)(3) that would suggest consideration of the monitoring station. This site is also located over 800 km from the National Radio Astronomy Observatory (“NRAO”) “quiet zone” located at Green Bank, West Virginia. Advance coordination is not required since the proposed operation does not fall under the quiet zone bounds contained in Section 73.1030(a)(1) of the FCC’s Rules. The proposed site is located over 700 km from the Canadian border and over 1400 km from the Mexican border. International coordination is thus not required.

Nearby Broadcast Stations – Interference Considerations

AM Stations: As discussed earlier in this Statement, *LCMS* holds an FCC Construction Permit, BP-20220926AAC, which authorizes the colocation of co-owned KFUE Clayton, Missouri (850 kHz, FCC Facility ID 39258) at this site. As described in the KFUE application proposal, no physical changes will be made to the existing KXFN array. The uninvolved other towers of the KXFN array are to be detuned at the KFUE frequency. Appropriate (diplexing) filters and traps are being designed and will be installed to permit concurrent operation of both stations while minimizing undesired interaction and spurious emissions outside of the limits specified in the FCC Rules. Post-construction spectrum analysis will be conducted to ensure that the FCC’s emission requirements have been met.

A complete Method-of-Moments Proof-of-Performance will be conducted on both the existing KXFN night array and the daytime KXFN antenna system proposed herein following the implementation of this daytime proposal and the addition of the KFUE antenna matching equipment. Base impedance measurements will be made after the installation of the diplexing equipment to establish the power determining reference for KFUE.

With respect to other nearby AM stations, based on information extracted from the FCC’s databases, it was determined that there are no other AM broadcast stations located within 11 km of the proposed site and none of the nearest stations is close enough to the proposed site to trigger consideration. As such, the notification/study distances set forth in FCC Rule Sections 1.30002(a) and (b) are not a factor; further, the proposed use of an existing tower would not involve any change to the tower structure. Accordingly, no adverse impact is expected to occur with regard to other existing AM stations as a result of a grant of this proposal.

FM and TV Stations: The closest FM station, the auxiliary facility for KLOU(FM), is located over 5 km distant. The next closest FM station is KXOK-LP, over 8 km distant. The nearest TV broadcast or TV translator authorization, the Construction Permit site for KDLT-LD is located over 5 km the proposed site. As such, undesired interaction and the generation of intermodulation products is not expected to occur with respect to nearby FM or TV stations due to the involved distances and the great separation in frequencies.

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Environmental Considerations – Site Factors and Human Exposure to Radiofrequency Radiation (RFR)

Site Factors: This application specifies the use of existing towers at an established transmitter site; no material changes will be required to implement the addition of the daytime mode at this site – the same four towers that are presently employed for the licensed nighttime operation will be used for the proposed day mode. According to the notes contained in FCC Rules Section 1.1306, the use of existing towers and sites is deemed to be an environmentally desirable alternative to the construction of new tower facilities. Accordingly, this proposal may be excluded from the provisions of Section 1.1306 of the FCC’s Rules and is not subject to environmental processing.

RF Exposure: The operation being proposed herein was evaluated for human exposure to radiofrequency energy (“RFR”) using the procedures outlined in the FCC’s **OET Bulletin No. 65** (“OET-65”). Based upon that methodology, and as will be shown in the following pages, it is believed the proposed modified KXFN operation will comply with those guidelines.

Two AM stations are authorized to employ the site specified herein – KXFN and KFUE. Accordingly, the contribution of both stations will be considered in this analysis. As discussed earlier, the transmitter site specified herein presently hosts the licensed 4-tower KXFN 1 kW nighttime antenna array. (This application proposes the relocation of the KXFN 1380 kHz daytime transmitting facility to this site, using the same 4 towers, but at an operating power of 2 kW.) Co-owned KFUE (850 kHz) holds a non-directional Construction Permit for the use on one of the towers at this site, at a nominal transmitter power of 3.8 kW during daytime hours. The electrical height of the four radiators at this site is 198.5° at the KXFN operating frequency of 1380 kHz. The electrical height of the involved radiator to be used for KFUE is 122.3° at 850 kHz. For the purposes of this analysis, an improbable “worst case” scenario will be employed, assuming that all towers are radiating 2 kW at 1380 kHz and 3.8 kW at 850 kHz.

A locked, posted fence is already in place around the existing antenna structures which limits access to distances no closer than 2.4 meters from any antenna conductor. Therefore, for the purposes of this analysis, a distance of 2.4 meters was assumed to be the “closest point of approach” to the radiating element. The results of this analysis for both stations are shown below.

KXFN(AM) 2 kW Exposure Summary Uncontrolled / General Population			
	<u>MPE</u> ⁷	<u>Calculated Value</u>	<u>Percent</u> ⁸
E (V/m):	597.1	203.904	11.66
H (A/m):	1.59	0.217	1.87

KFUE(AM) 3.8 kW Exposure Summary Uncontrolled / General Population			
	<u>MPE</u> ⁷	<u>Calculated Value</u>	<u>Percent</u> ⁸
E (V/m):	614	141.394	5.30
H (A/m):	1.63	0.479	8.64

⁷ The term “MPE” in the above tabulations denotes the FCC’s maximum permissible exposure limit guidelines.

⁸ Percent values are derived from the squares of the calculated electric or magnetic field strengths, per page 33 of *OET Bulletin 65*, Edition 97-01, August 1997.

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As shown in the preceding tabulations, for the proposed KXFN 2 kW daytime operation, the OET-65 calculated total *electrical field* at the presumed 2.4 meter closest point of approach would be 11.66% of the uncontrolled/general population limit. The calculated magnetic field would be 1.87% of this limit. For the 3.8 kW KFUE operation, the OET-65 calculated total *electrical field* at the presumed 2.4 meter closest point of approach would be 5.3% of the uncontrolled/general population limit. The calculated magnetic field would be 8.64% of this limit. When considering the total contributions of the proposed 2 kW daytime KXFN operation⁹ and the daytime KFUE CP facility, assuming both were operated simultaneously, the total calculated electrical field at the fence boundary would be 16.96% (11.66% plus 5.30%) while the total calculated magnetic field at the fence boundary would be 10.51% (1.87% plus 8.64%), which is *well below* the FCC's maximum uncontrolled RFR limit. Further, since KXFN involves a directional antenna system for the proposed daytime operation and for the existing nighttime operation, the nominal power discussed above would be distributed amongst the towers and not radiated out of one element.

Finally, RF exposure and warning signs will continue to be posted on all fence faces and enclosure entry points. As a result, members of the general public are not expected to be exposed to RF energy in excess of the FCC's published Uncontrolled/General Population guidelines.

With respect to worker safety, a site exposure policy will continue to be employed to protect authorized workers from excessive RF exposure when work must be performed in the vicinity of or on the tower. Such protective measures include, but are not limited to, restriction of access to areas where levels in excess of the guidelines may be expected, power reduction, occupancy time limits, or the complete shutdown of facilities when work or inspections must be performed in areas where the exposure guidelines will be exceeded. Further, no worker will be permitted to climb or work on an energized tower.

Based on the preceding, it is believed that this proposal will be in compliance with the FCC's present RF exposure requirements.

⁹ The existing 1 kW KXFN nighttime operation is being ignored for this analysis since the proposed 2 kW daytime operation would be a worst case maximum power at this frequency into this antenna array.