Comprehensive Engineering Statement

prepared for

Lutheran Church-Missouri Synod

K224FT St. Louis, MO

Facility ID 202990

Channel 224D 0.1 kW 233 m AMSL

Lutheran Church-Missouri Synod ("*Lutheran*") is the licensee of fill-in translator K224FT (file no. 0000166610) on Channel 224D utilizing a directional antenna. There is also a Construction Permit ("CP") for K224FT (file no. 0000202876) which authorizes a move to an existing tower utilizing a different directional antenna system under a Mattoon waiver. K224FT is a fill-in translator for Standard Broadcast Station KFUO(AM), 850 kHz, Clayton, Missouri. *Lutheran* proposes to modify the CP to specify the same registered tower, ASRN 1225623, located at 38° 45' 07.3"N, 90° 37' 22.6"W (NAD 83), the same directional antenna, and an increase in ERP as part of a minor modification. An ERP of 0.2 kW (200 Watts) is being requested.

Nature of the Proposal

The antenna system for the proposed translator is a Shively model SLV-4-.82SS antenna, a 4-bay, 0.82 wavelength spaced directional antenna which will be side-mounted on an existing antenna support structure. No change in structure overall height is necessary to carry out this proposal. Since no change to the structure's overall height is proposed, no change to structure marking/lighting requirements will result. **Figure 1** provides a graphical representation of the proposed antenna azimuth pattern. A tabulation of the pattern is provided in the engineering sections of the form.

A Mattoon waiver was requested in support of the current CP authorization. Since the proposed modification specifies the same channel, antenna location and antenna height (and an increase in power), the current proposal still qualifies under all Mattoon considerations.

Figure 2 depicts the proposed contour, the parent station KFUO(AM) 2 mV/m contour, and the 40 km (25 mile) radius from the KFUO(AM) transmitter site. As shown, the contour of the proposed facility within the greater of the 2 mV/m contour and the 40 km radius of the parent station, KFUO(AM), thus complying with §74.1201(g).

Allocation Considerations

A study of nearby FM facilities on co-channel, adjacent-channel, and intermediate frequencies was conducted to identify which stations require further study to demonstrate compliance under §74.1204. **Table I** provides a listing of nearby co-channel, first, second and third adjacent facilities to be considered. The listing was developed by specifying K224FT as a Class A, thus resulting in a list of stations and translators that should be considered for contour protection. Contour protection for pertinent co-channel and first adjacent stations is demonstrated in **Figure 3**. The nearest co-channel channel full service station is WMAY(FM) (Ch. 224B1, Taylorville, IL) and the nearest co-channel LPFM is KFTN-LP, (Ch. 224L1, Fenton, MO) at 29.93 km. The nearest first adjacent channel stations are KWRH-LP (Ch. 225L1, Webster Groves, MO) at 25.93 km, and full service KGRC(FM) (Ch. 225C1, Hannibal, MO) at 130.25 km. As shown, no prohibited contour overlap from the proposed facility will exist to nearby co-channel or first adjacent facilities.

Figure 4 depicts the protected contours of pertinent second and third adjacent facilities near the proposal. The proposed facility is just outside the 60 dBµ contour of the KRTK(FM) license, is inside the 60 dBµ contour of the KRTK(FM) CP, and inside the 60 dBµ contour of WIL-FM (Ch. 222C0, St. Louis, MO). **Figure 4A (Detail)** provides a greatly expanded view of the proposed 103.6 dBµ interfering contour in relation to the KRTK(FM) license. As shown, the proposed interfering contour does not overlap the protected contour of the KRTK(FM) license. Protection of both WIL-FM and the KRTK(FM) CP is achieved pursuant to §74.1204(d) by demonstrating that the proposed translator's interfering contour does not reach populated areas. The proposed K224FT facility will be located just inside the WIL-FM 77 dBµ F(50,50) contour (not shown), and just inside the 63.6 dBµ contour of the KRTK(FM) license as depicted in **Figure 4A (Detail)**. Thus, based on the 40 dB interfering-to-protected contour ratio for second and third adjacent facilities, the worst-case interfering contour is the 103.6 dBµ contour.

Based on the -40 dB desired-to-undesired ratio specified in §74.1204(a)(3), the appropriate second-adjacent interfering signal level at this location is 103.6 dBµ. The proposed facility's antenna will be mounted at 91.4 meters above ground level. Utilizing the proposed manufacturer's elevation pattern (a 4-bay, 0.82 wavelength spaced antenna), calculations were performed at two meters above the ground out to 1,000 meters from the proposed transmitter site. **Figure 5** provides

a graphical representation of the proposed antenna's elevation pattern. As demonstrated in **Figure 6**, the greatest signal strength at two meters above ground near the tower is 103.57 dBµ at a distance of 74 meters from the tower. A review of satellite imagery tells us that there are no public roads or private dwellings/property within 80 meters of the proposed transmitter. Thus, the proposed translator's interfering signal does not exceed the level of 103.6 dBµ that would be considered interference to surrounding population at ground level or nearby buildings. The nearest IF relationship (53 or 54 channels removed) facility near the proposal is KLOU(FM) (Ch. 277C1, St. Louis, MO) at a distance of 32.54 km. As shown on **Table I**, the FCC spacing requirement is 22.0 km, demonstrating compliance.

The proposed site is located more than 700 km from the Canadian and Mexican borders, well beyond the 320 km coordination distance required for translators specified in §74.1235(d). The nearest FCC monitoring station is 582.1 km distant at Allegan, MI. This distance exceeds the threshold minimum distance specified in §73.1030 that would suggest consideration of the monitoring station.

It is therefore believed that the proposed facility satisfies all of the pertinent Commission Rules and Policies now in effect regarding allocation matters.

Environmental Considerations

The proposed facility will operate with a circularly-polarized ERP of 200 Watts with a four-bay, 0.82 wavelength spaced, directional antenna, at 91.4 meters AGL on registered tower, ASRN 1225623, which also provides support for at least one other broadcast facility. The use of existing transmitting locations has been characterized as being environmentally preferable by the Commission, according to Note 1 of §1.1306 of the FCC Rules. Because no change in structure height is proposed, no change in current structure marking and lighting requirements is anticipated. Therefore, it is believed that this application may be categorically excluded from environmental processing pursuant to §1.1306 of the Commission's rules.

Human Exposure to Radiofrequency Radiation

The proposed operation was evaluated for human exposure to radiofrequency energy using the procedures outlined in the Commission's OET Bulletin No. 65 ("OET 65"). OET 65 describes a

means of determining whether a proposed facility meets the radiofrequency exposure guidelines adopted in §1.1310. Under present Commission policy, a facility may be presumed to comply with the limits specified in §1.1310 if it satisfies the exposure criteria set forth in OET 65. Based upon that methodology, and as demonstrated in the following, the proposed transmitting system will comply with the cited adopted guidelines.

The general population/uncontrolled maximum permitted exposure ("MPE") limit specified in §1.1310 for the entire FM broadcast band is 200 $\mu W/cm^2$. For the purpose of this study, "public access" will be considered at the base of the tower at locations two-meters above ground.

Using the FCC's FM Model program and an EPA Type 3 ("Opposed U Dipole") antenna it was determined that the proposed facility would contribute a worst-case RF power density of 0.0268 $\mu W/cm^2$ at two meters above ground level near the antenna support structure, or 0.0134 percent of the general population/uncontrolled limit.

§1.1307(b)(3) states that facilities at locations with multiple emitters may be excluded from responsibility for taking any corrective action in the areas where their contribution is less than five percent of the pertinent MPE limit. Since the instant situation meets the five percent exclusion test at all ground level areas, the impact of any other facilities near this site may be considered independently from this proposal. Accordingly, it is believed that the impact of the proposed operation should not be considered to be a factor at ground level as defined under §1.1307(b).

Safety of Tower Workers and the General Public

As demonstrated herein, excessive levels of RF energy will not be caused by the proposal at publicly accessible areas at ground level near the antenna supporting structure. Consequently, members of the general public will not be exposed to RF levels in excess of the Commission's guidelines. Nevertheless, tower access will continue to be restricted and controlled through the use of a locked fence. According to information provided by the applicant, appropriate RF exposure warning signs are posted. In the event that maintenance or other workers gain access to the tower, power output of the translator will be decreased or shut off to protect workers.

With respect to worker safety, it is believed that based on the preceding analysis, excessive exposure would not occur in areas at ground level. A site exposure policy will be employed

protecting maintenance workers from excessive exposure when work must be performed on the tower in areas where high RF levels may be present. Such protective measures may include, but will not be limited to, restriction of access to areas where levels in excess of the guidelines may be expected, power reduction, or the complete shutdown of facilities when work or inspections must be performed in areas where the exposure guidelines would otherwise be exceeded. On-site RF exposure measurements may also be undertaken to establish the bounds of safe working areas. The applicant will coordinate exposure procedures with all pertinent stations. Based on the preceding, it is believed that the instant proposal may be categorically excluded from environmental processing under §1.1306 of the Rules, hence preparation of an Environmental Assessment is not required.

Conclusion

It is therefore believed that the proposed facility satisfies all of the pertinent Commission Rules and Policies now in effect.

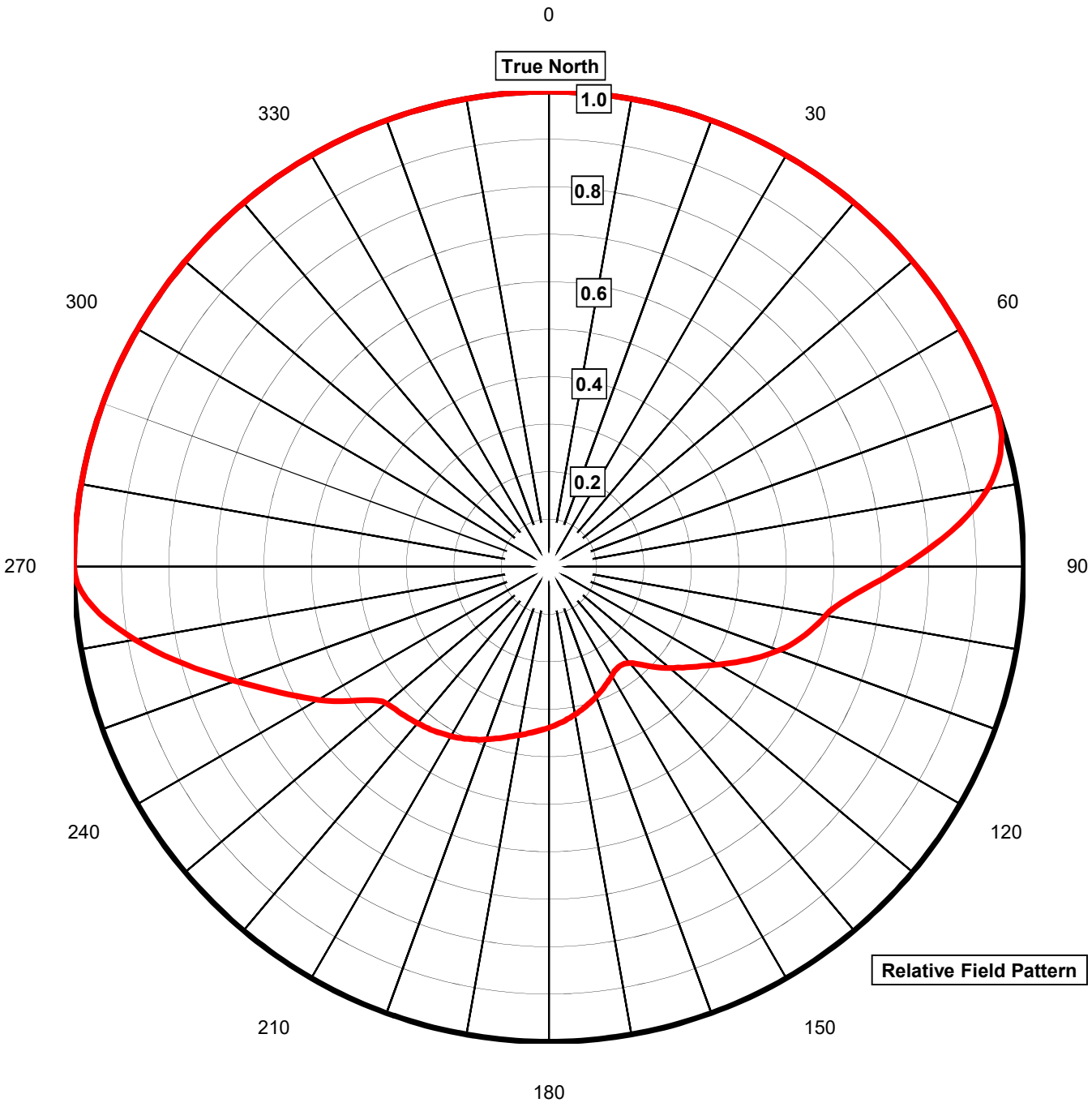


FIGURE 1

ANTENNA HORIZONTAL PLANE RADIATION PATTERN (Envelope)

prepared August 2023 for

Lutheran Church-Missouri Synod

K224FT St. Louis, Missouri

Facility Id 202990

Ch. 224D 0.2 kW 233 m AMSL

Cavell, Mertz & Associates, Inc.

Manassas, Virginia

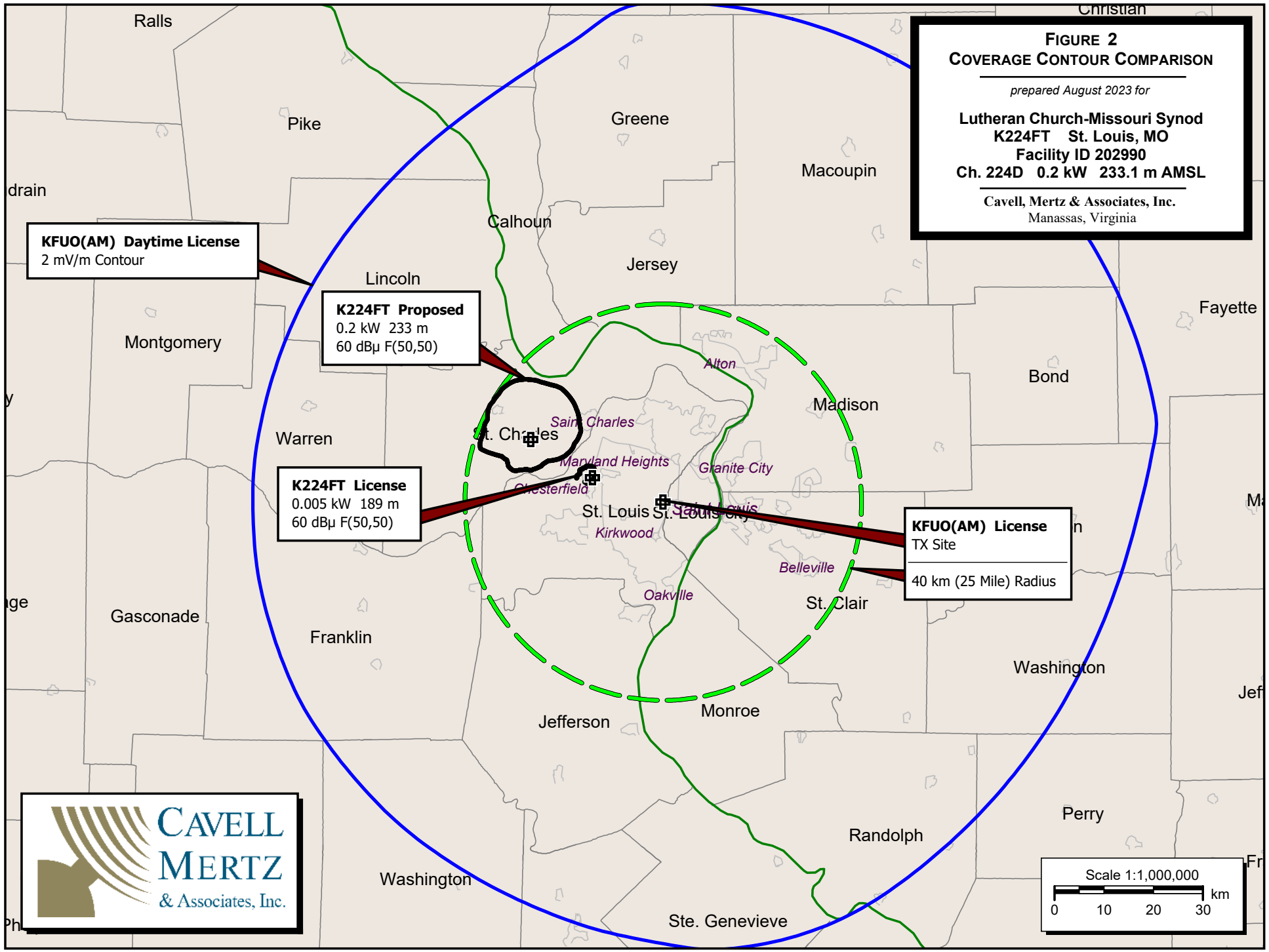


FIGURE 2
COVERAGE CONTOUR COMPARISON
prepared August 2023 for
Lutheran Church-Missouri Synod
K224FT St. Louis, MO
Facility ID 202990
Ch. 224D 0.2 kW 233.1 m AMSL
Cavell, Mertz & Associates, Inc.
Manassas, Virginia
KFUO(AM) Daytime License
2 mV/m Contour
K224FT Proposed
0.2 kW 233 m
60 dBµ F(50,50)
K224FT License
0.005 kW 189 m
60 dBµ F(50,50)
KFUO(AM) License
TX Site
40 km (25 Mile) Radius
Ralls
Pike
Greene
Macoupin
Calhoun
Jersey
Lincoln
Montgomery
Warren
Fayette
Bond
Madison
Alton
St. Charles
Maryland Heights
Granite City
Chesterfield
St. Louis
Kirkwood
Belleville
Oakville
St. Clair
Gasconade
Franklin
Washington
Jefferson
Monroe
Perry
Randolph
Ste. Genevieve
CAVELL MERTZ & Associates, Inc.
Scale 1:1,000,000
km
0 10 20 30

Table I

ALLOCATION SPACING SUMMARY FOR K224FT

prepared for

Lutheran Church-Missouri Synod

K224FT St. Louis, Missouri

Facility ID 202990

Ch. 224D 0.2 kW 233 m AMSL

REFERENCE — DISPLAY DATES

38 45 07.30 N. — CLASS = A — DATA 08-31-23

90 37 22.60 W. — Current Spacings to 3rd Adj. — SEARCH 08-31-23

Channel 224 - 92.7 MHz

Call	Channel		Location		Azi	Dist	FCC	Margin
WIL-FM_%	LIC	222C0	St. Louis	MO	146.9	35.77	86.0	-50.2
~~K224FT~~	~~CP -D~~	~~224D~~	~~St. Louis~~	~~MO~~	~~0.0~~	~~0.00~~	~~47.0~~	~~-47.0~~[1]
KFTN-LP	LIC	224L1	Fenton	MO	156.7	28.35	67.0	-38.7
K224FT	LIC-D	224D	St. Louis	MO	121.7	14.64	47.0	-32.4
KWRH-LP	LIC	225L1	Webster Groves	MO	127.0	29.95	56.0	-26.1
KRTK_%	LIC-N	227C2	Hermann	MO	279.6	44.65	55.0	-10.4
WMAY-FM	LIC	224B1	Taylorville	IL	43.6	137.75	143.0	-5.3
KGRC	LIC	225C1	Hannibal	MO	328.5	127.87	133.0	-5.1
K224EZ	LIC-D	224D	Union	MO	230.6	47.16	47.0	0.16
W224DC	LIC-D	224D	Caseyville	IL	104.2	54.93	47.0	7.9
KLOU	LIC	277C1	St. Louis	MO	127.3	32.54	22.0	10.5
KLOZ	LIC	224C2	Eldon	MO	255.7	177.68	166.0	11.7
K227DS	LIC	227D	St. Louis	MO	121.7	29.36	8.0	21.4

% = Station Fails minimum 73.215 spacings

[1] K224FT listed is the current CP authorization to be modified.

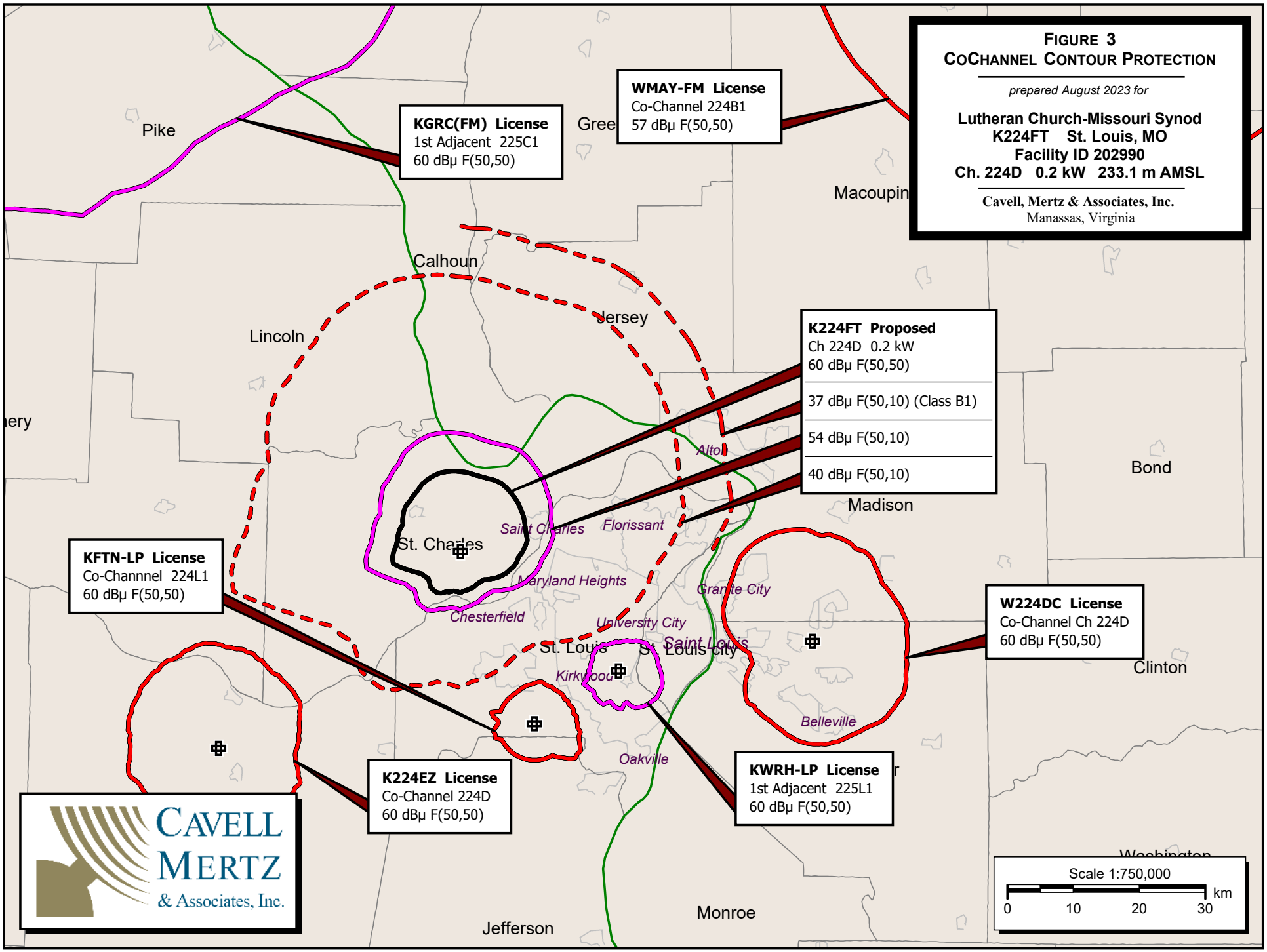


FIGURE 3
COCHANNEL CONTOUR PROTECTION
prepared August 2023 for
Lutheran Church-Missouri Synod
K224FT St. Louis, MO
Facility ID 202990
Ch. 224D 0.2 kW 233.1 m AMSL
Cavell, Mertz & Associates, Inc.
Manassas, Virginia
KGRC(FM) License
1st Adjacent 225C1
60 dBµ F(50,50)
WMAY-FM License
Co-Channel 224B1
57 dBµ F(50,50)
K224FT Proposed
Ch 224D 0.2 kW
60 dBµ F(50,50)
37 dBµ F(50,10) (Class B1)
54 dBµ F(50,10)
40 dBµ F(50,10)
KFTN-LP License
Co-Channnel 224L1
60 dBµ F(50,50)
W224DC License
Co-Channel Ch 224D
60 dBµ F(50,50)
K224EZ License
Co-Channel 224D
60 dBµ F(50,50)
KWRH-LP License
1st Adjacent 225L1
60 dBµ F(50,50)
Pike
Calhoun
Jersey
Lincoln
Macoupin
Madison
Bond
Clinton
Monroe
Jefferson
St. Charles
Saint Charles
Florissant
Maryland Heights
Chesterfield
University City
St. Louis
St. Louis city
Saint Louis
Kirkwood
Oakville
Belleville
Granite City
Alton
CAVELL MERTZ & Associates, Inc.
Scale 1:750,000
0 10 20 30 km

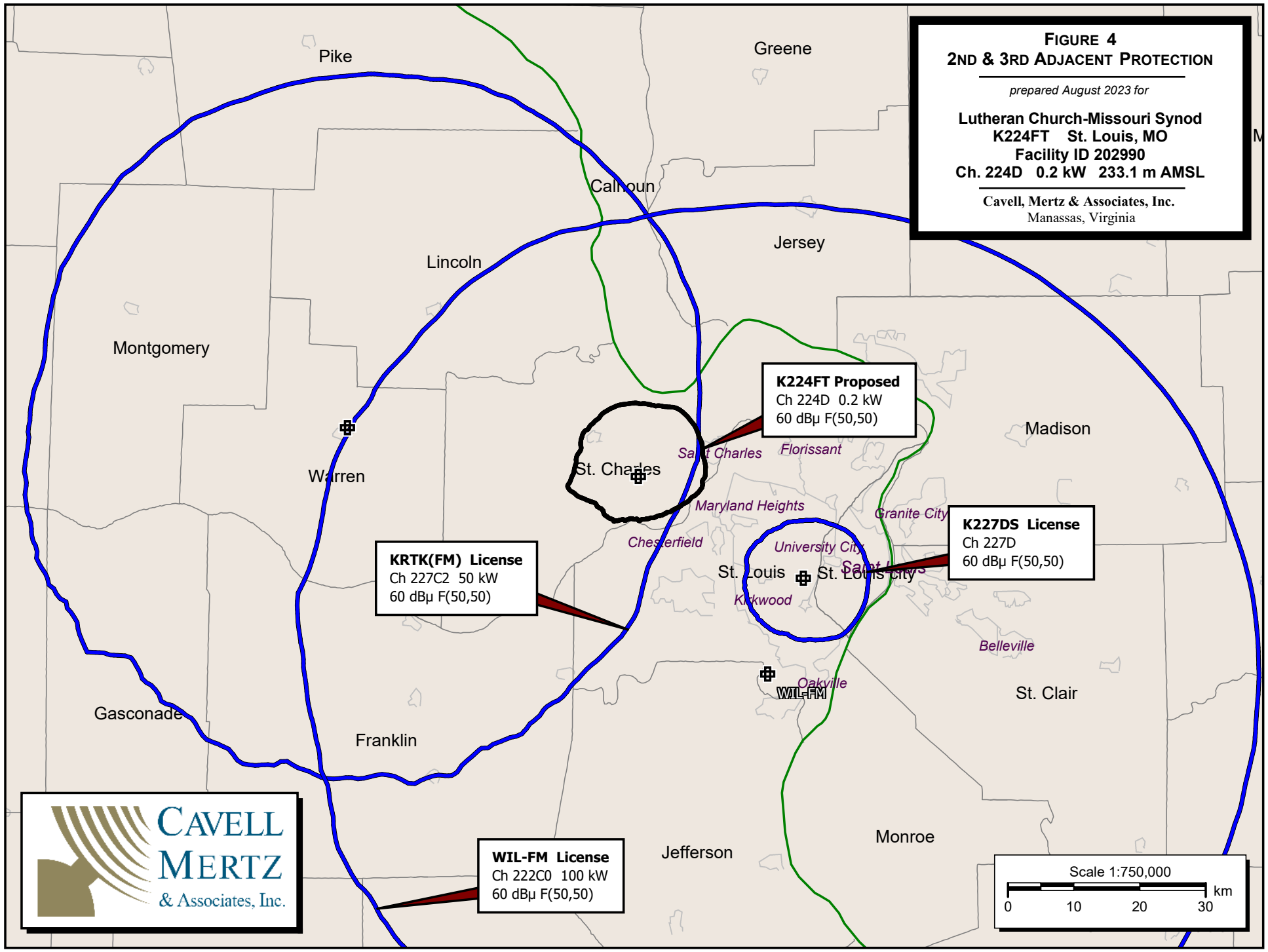


FIGURE 4
2ND & 3RD ADJACENT PROTECTION
prepared August 2023 for
Lutheran Church-Missouri Synod
K224FT St. Louis, MO
Facility ID 202990
Ch. 224D 0.2 kW 233.1 m AMSL
Cavell, Mertz & Associates, Inc.
Manassas, Virginia
Pike
Greene
Calhoun
Jersey
Lincoln
Montgomery
Warren
Madison
St. Charles
Saint Charles
Florissant
Maryland Heights
Granite City
Chesterfield
University City
St. Louis
St. Louis City
Kirkwood
Belleville
Oakville
WIL-FM
St. Clair
Gasconade
Franklin
Jefferson
Monroe
K224FT Proposed
Ch 224D 0.2 kW
60 dBµ F(50,50)
K227DS License
Ch 227D
60 dBµ F(50,50)
KRTK(FM) License
Ch 227C2 50 kW
60 dBµ F(50,50)
WIL-FM License
Ch 222C0 100 kW
60 dBµ F(50,50)
CAVELL MERTZ & Associates, Inc.
Scale 1:750,000
km
0
10
20
30

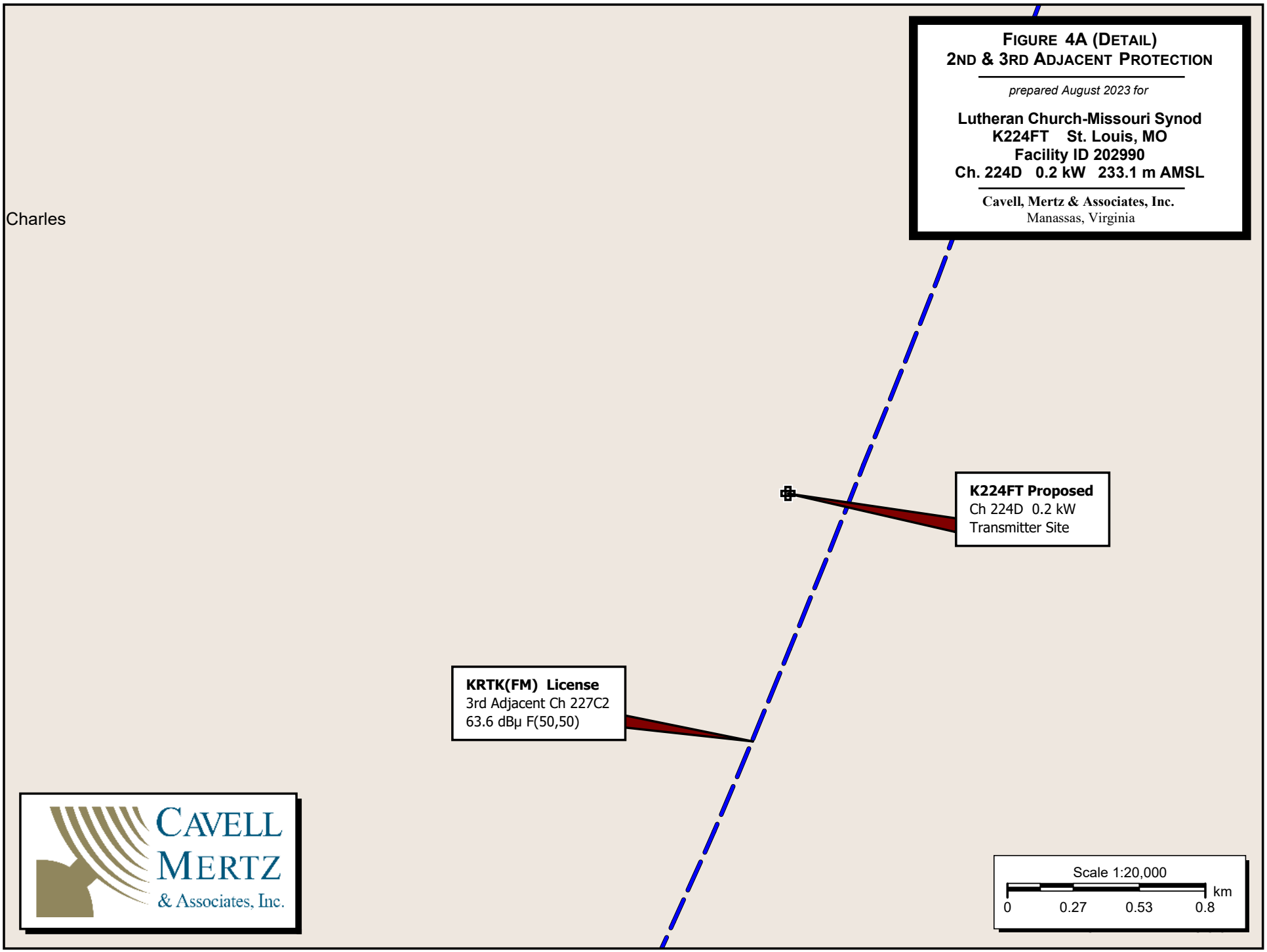


FIGURE 4A (DETAIL)
2ND & 3RD ADJACENT PROTECTION
prepared August 2023 for
Lutheran Church-Missouri Synod
K224FT St. Louis, MO
Facility ID 202990
Ch. 224D 0.2 kW 233.1 m AMSL
Cavell, Mertz & Associates, Inc.
Manassas, Virginia
Charles
K224FT Proposed
Ch 224D 0.2 kW
Transmitter Site
KRTK(FM) License
3rd Adjacent Ch 227C2
63.6 dBµ F(50,50)
CAVELL MERTZ & Associates, Inc.
Scale 1:20,000
km
0
0.27
0.53
0.8

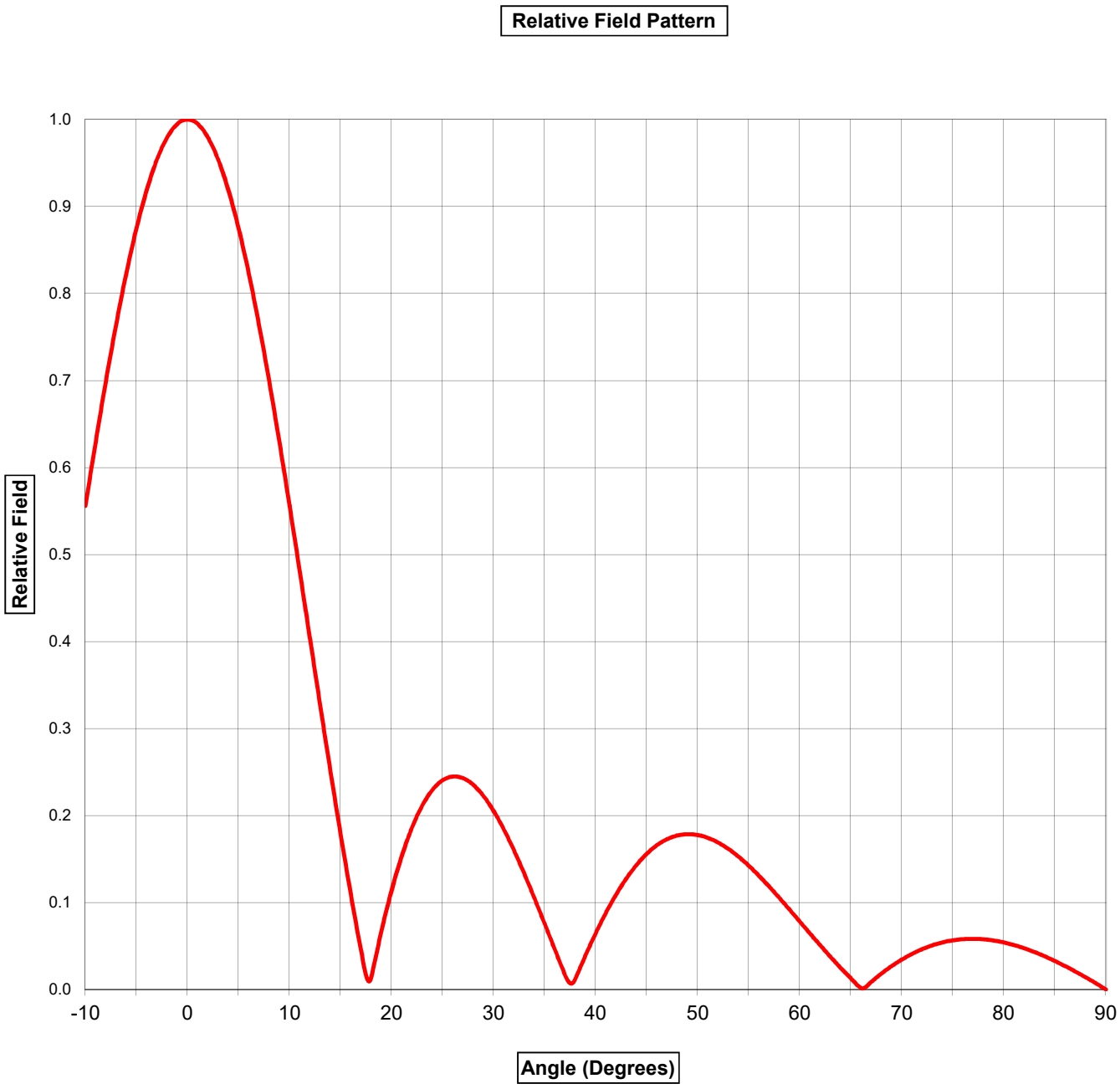


FIGURE 5

ANTENNA VERTICAL (ELEVATION) PLANE RADIATION PATTERN

prepared August 2023 for

Lutheran Church-Missouri Synod
K224FT St. Louis, Missouri
Facility Id 202990
Ch. 224D 0.2 kW 233 m AMSL

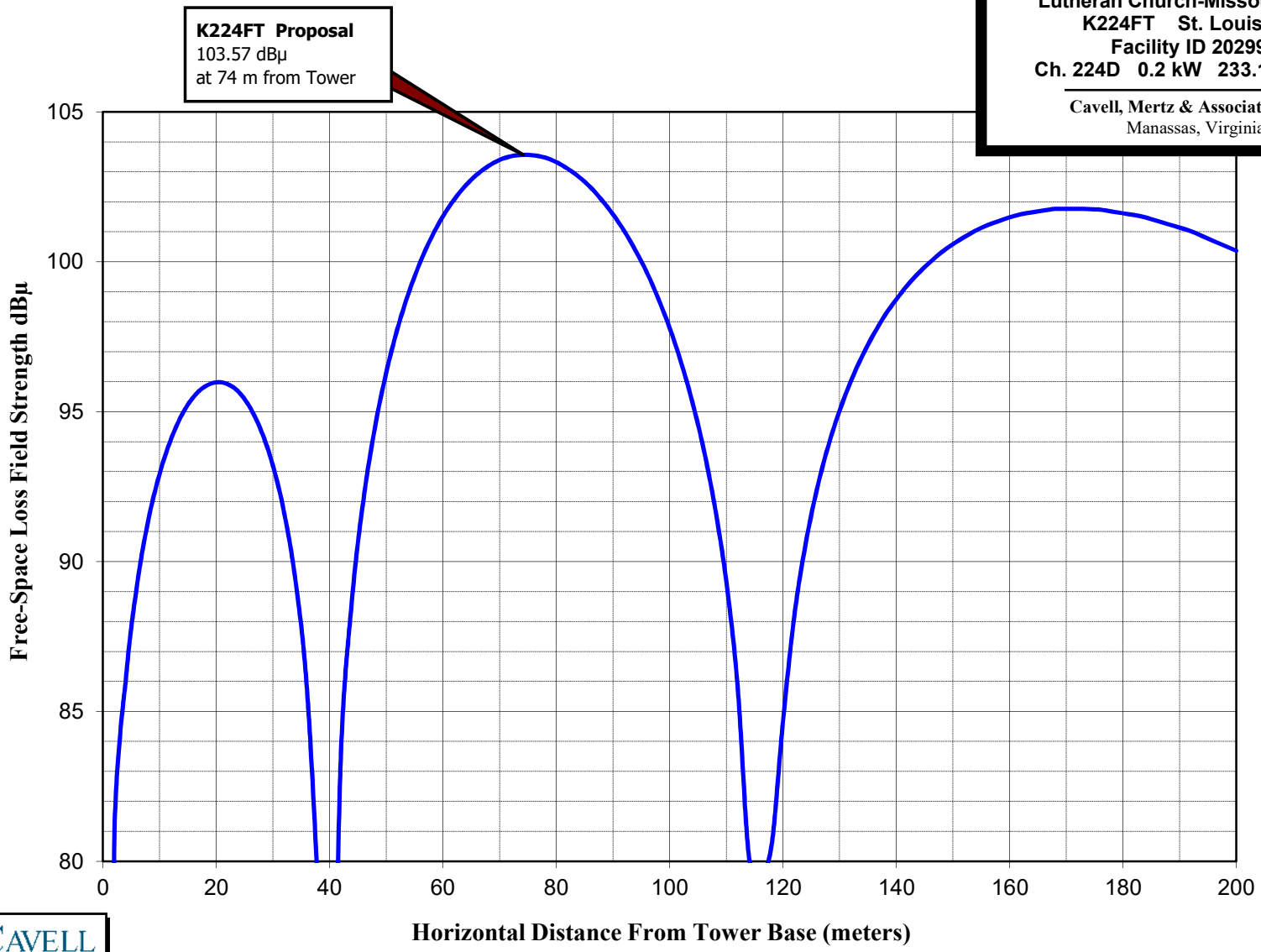
Cavell, Mertz & Associates, Inc.
Manassas, Virginia

FIGURE 6
POWER IN dBμ AT 2M ABOVE GROUND

prepared August 2023 for

Lutheran Church-Missouri Synod
K224FT St. Louis, MO
Facility ID 202990
Ch. 224D 0.2 kW 233.1 m AMSL

Cavell, Mertz & Associates, Inc.
Manassas, Virginia



CAVELL MERTZ & Associates, Inc.