March 2015
FM Translator K258CN
Richland, Washington Channel 258D
Allocation Study

The attached spacing study shows the spacing between the proposed translator site and the location of cochannel and adjacent channel stations and proposals. This study was made with the Commission's Class A spacing requirements, and individual situations were examined to determine the lack of prohibited contour overlap per the requirements of §74.1204 of the Rules. The attached allocation study map demonstrates compliance with the Commission's Rules for protection of FM broadcast stations and FM translators as outlined in §74.1204.

The proposed translator transmitter site is located within the 60 dBu protected contour of second-adjacent channel station KUJ-FM 256C1 Burbank. The proposed site is just 0.55 km from the KUJ-FM transmitter site. Given the KUJ-FM antenna's minimum azimuthal ERP of 3.8 kW, KUJ-FM places a minimum 117.9 dBu contour at the translator transmitter site. The corresponding interfering contour from the translator is 117.9 + 40 = 157.9 dBu. The 157.9 dBu contour would extend just 0.9 meters from the transmitting antenna per a Free Space calculation, and would not reach ground level. There is no population within this contour. Therefore, the proposed facility is believed to satisfy the requirements of §74.1204(d) with respect to KUJ-FM.

Since the proposed facility will operate with an ERP of less than 100 watts, there are no spacing restrictions to stations which are 53 or 54 channels removed from the proposed operation.

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SEARCH PARAMETERS FM Database Date: 150227

Channel: 258A 99.5 MHz

Latitude: 46 6 15

Longitude: 119 7 48

Safety Zone: 50 km

Job Title: K258CN RICHLAND

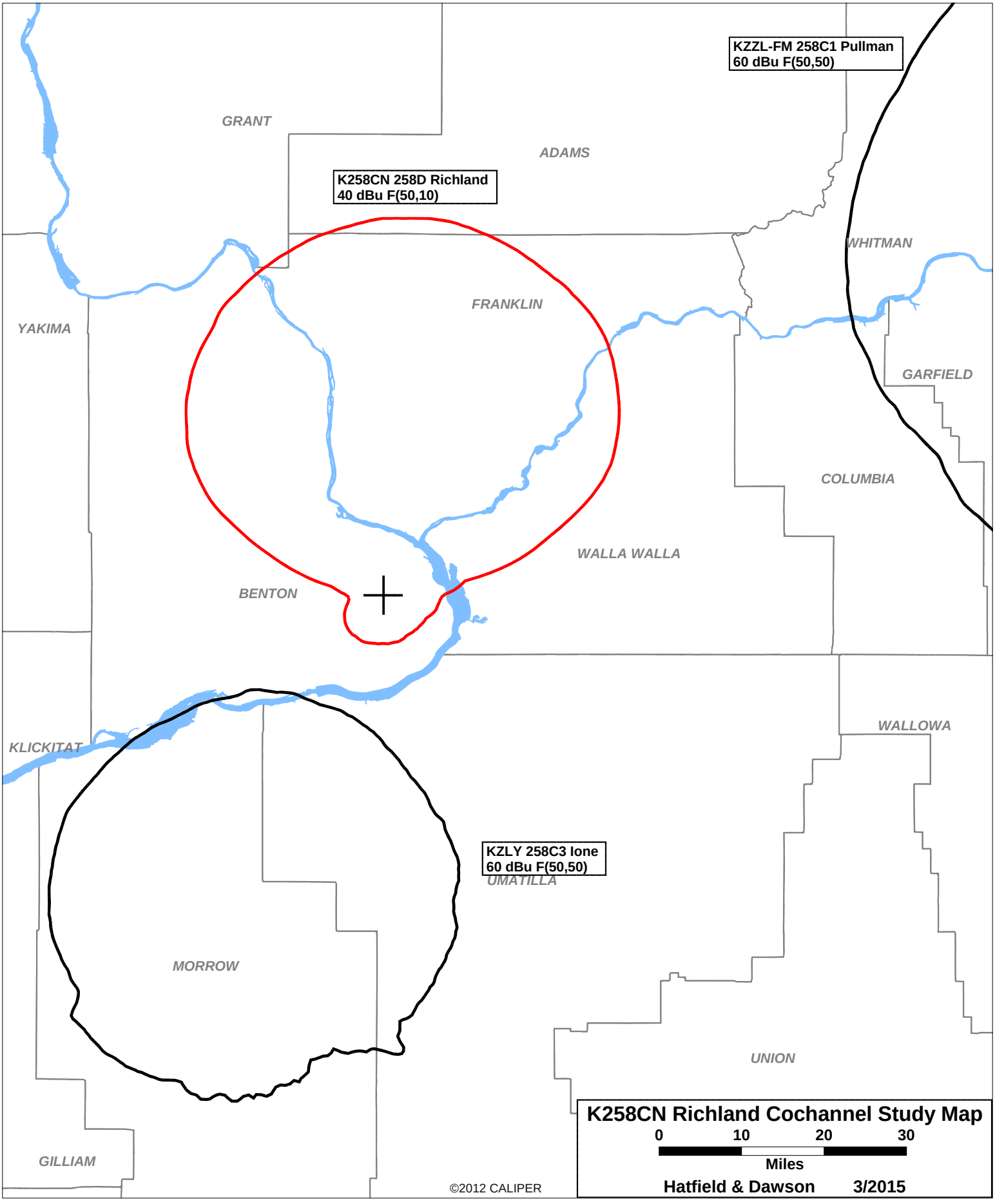
Call Status	City St	FCC File No.	Channel Freq.	ERP(kW) HAAT(m)		Latitude Longitude	Bearing deg-True	Dist (km)	Req (km)
K204CZ	KENNEWICK		204D	0.010	DA	46-06-15	83.1	0.26	0
LIC	WA	BLFT-90430ABI	88.7	544.0		119-07-36		0.00	TRANS
KUJ-FM	BURBANK		256C1	52.000	DA	46-05-58	161.9	0.55	75
LIC	WA	BLH-60905AAY	99.1	385.0		119-07-40	SS	-74.45	SHORT
KUJ-aux	BURBANK		256C1	5.000		46-13-18	341.7	13.76	0
CP	WA	BXPH-30122ADS	99.1	-15.0		119-11-10		0.00	AUX
KDRM	MOSES LAKE		257A	3.000		47-05-54	353.5	111.25	72
LIC	WA	BLH-801112AJ	99.3	61.0		119-17-47		39.25	CLEAR
KZLY	IONE		258C3	1.800		45-29-12	198.9	72.52	142
LIC	OR	BLH-31126BMX	99.5	370.0		119-25-52	SS	-69.48	SHORT
K258BM	LA GRANDE		258D	0.099		45-20-53	136.6	115.23	0
LIC	OR	BLFT-10525ABW	99.5	129.0		118-07-02		0.00	TRANS
	PULLMAN		258C	0.000		46-40-49	68.8	183.93	226
RSV	WA	RM-coord-22	99.5	0.0		116-53-18		-42.07	SHORT
KZZL-FM	PULLMAN		258C1	81.000		46-40-52	68.0	178.01	200
LIC	WA	BMLH-20920AAD	99.5	323.0		116-58-16		-21.99	SHORT
K258CN	RICHLAND		258D	0.099	DA	46-06-15	0.0	0.00	0
CP	WA	BNPFT-30823ABG	99.5	538.0		119-07-48		0.00	TRANS
K261BS	MILTON-FREEWATER		259D	0.170	DA	45-59-23	99.5	74.98	0
CP	OR	BPFT-41110ADI	99.7	813.0		118-10-31		0.00	TRANS
KHHK	YAKIMA		259C3	4.100		46-31-20	297.1	103.84	89
LIC	WA	BMLH-40204ABJ	99.7	245.0		120-20-08		14.84	CLEAR
KHHKaux	YAKIMA		259C3	1.000		46-36-09	298.2	119.36	0
LIC	WA	BXLH-40718ABA	99.7	-59.0		120-30-13		0.00	AUX
	HERMISTON		261A	0.000		45-51-57	207.8	29.96	31
RSV	OR	RM-11242	100.1	0.0		119-18-38		-1.04	SHORT

SEARCH PARAMETERS FM Database Date: 150227

Channel: 258A 99.5 MHz
Latitude: 46 6 15
Longitude: 119 7 48
Safety Zone: 50 km
Job Title: K258CN RICHLAND

Call Status	City St FCC File No.	Channel Freq.	ERP(kW) HAAT(m)	Latitude Longitude	Bearing deg-True	Dist (km)	Req (km)
	HERMISTON	261A	0.000	45-51-57	208.0	30.00	31
	OR RM-inv-54	100.1	0.0	119-18-42		-1.00	SHORT
KQFM	HERMISTON	261A	5.300	45-51-57	208.0	30.00	31
LIC	OR BLH-00211ABO	100.1	94.0	119-18-42		-1.00	SHORT
K261BS	MILTON-FREEWATER	261D	0.190	46-02-33	96.1	62.01	0
LIC	OR BLFT-21004ABK	100.1	146.0	118-20-00		0.00	TRANS
KRKG-FM	PASCO	261A	0.450	46-06-15	0.0	0.00	31
APP	WA BMPH-41119ACU	100.1	361.0	119-07-48		-31.00	SHORT
NOTE:	PARENT STATION FOR K258CN						
KRKG-FM	PASCO	261A	0.880	46-14-04	314.7	20.63	31
CP	WA BPH-30529AIA	100.1	262.0	119-19-13		-10.37	SHORT
NOTE:	PARENT STATION FOR K258CN						

==== END OF FM SPACING STUDY FOR CHANNEL 258 ====


KZZL-FM 258C1 Pullman
60 dBu F(50,50)
K258CN 258D Richland
40 dBu F(50,10)
KZLY 258C3 Ione
60 dBu F(50,50)
GRANT
ADAMS
WHITMAN
FRANKLIN
YAKIMA
GARFIELD
COLUMBIA
WALLA WALLA
BENTON
KLICKITAT
WALLOWA
UMATILLA
MORROW
UNION
GILLIAM
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K258CN Richland Cochannel Study Map
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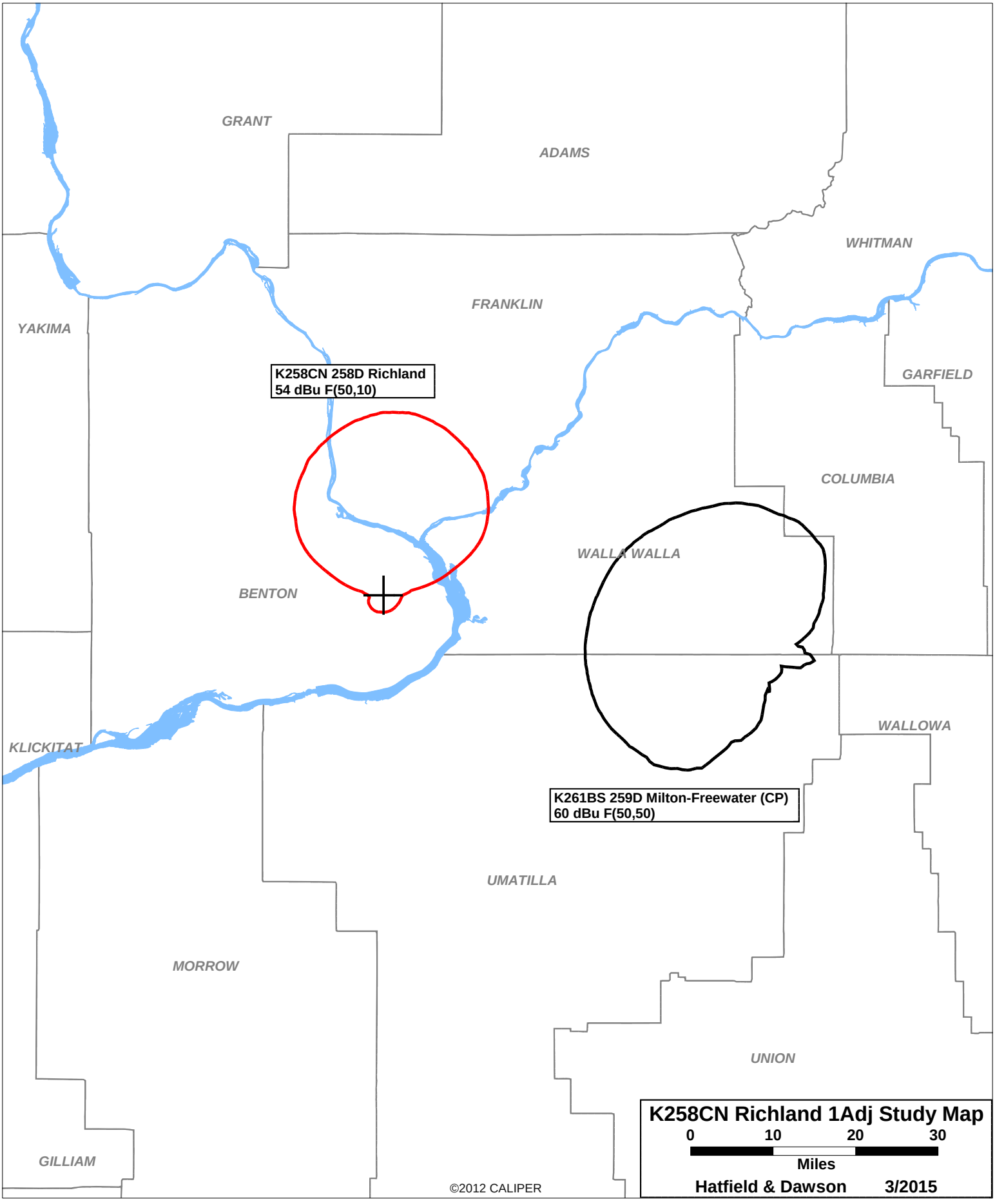
Hatfield & Dawson 3/2015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UMATILLA
MORROW
UNION
GILLIAM
K258CN 258D Richland
54 dBu F(50,10)
K261BS 259D Milton-Freewater (CP)
60 dBu F(50,50)
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K258CN Richland 1Adj Study Map
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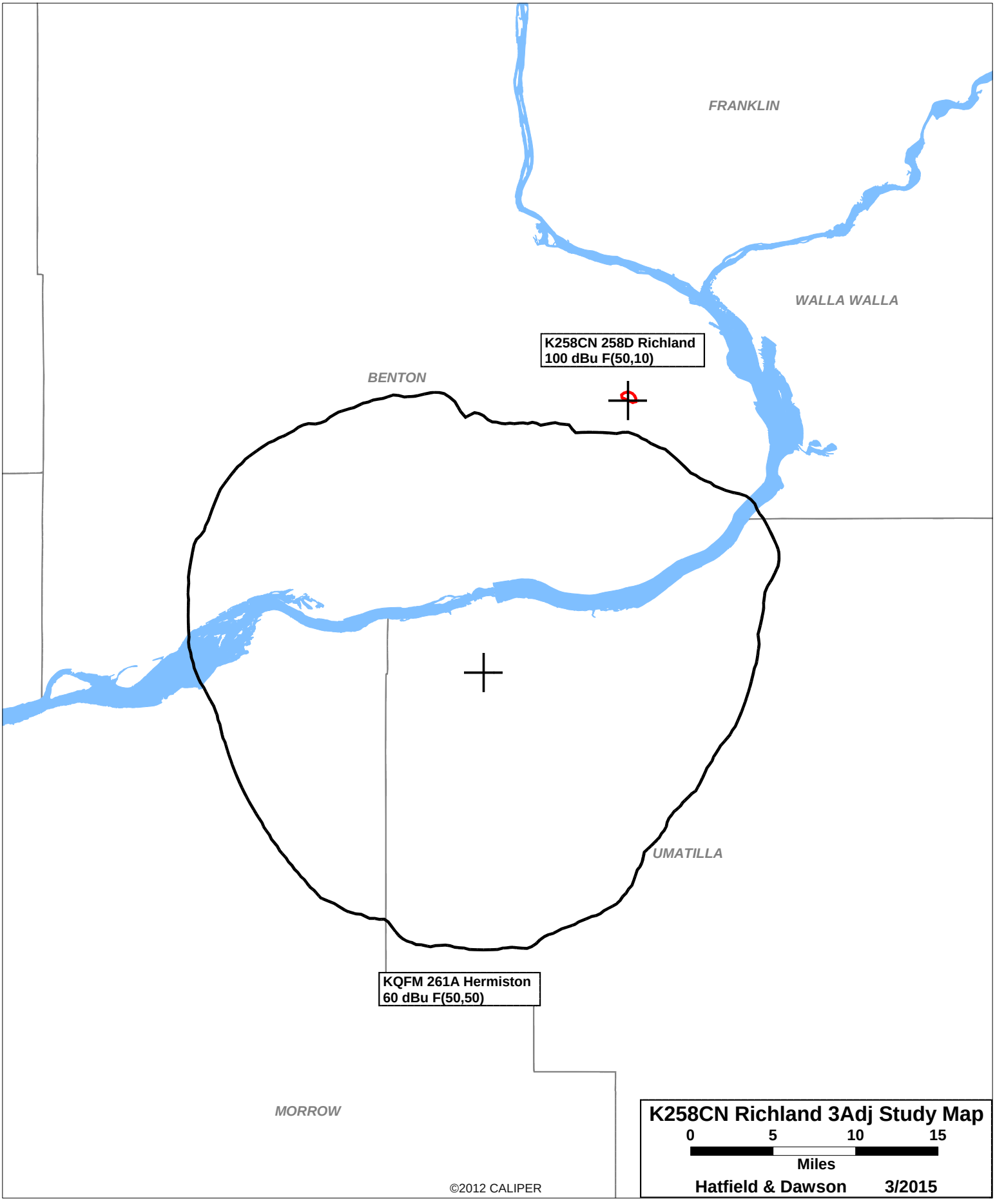
FRANKLIN
WALLA WALLA
K258CN 258D Richland
100 dBu F(50,10)
BENTON
UMATILLA
KQFM 261A Hermiston
60 dBu F(50,50)
MORROW
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K258CN Richland 3Adj Study Map
0 5 10 15
Miles
Hatfield & Dawson 3/2015

March 2015
FM Translator K258CN
Richland, Washington Channel 258D
RF Exposure Study

Facilities Proposed
The proposed operation will be on Channel 258D (99.5 MHz) with a maximum lobe effective radiated power of 99 watts. Operation is proposed with an antenna to be mounted on an existing tower on Jump Off Joe Butte.

The proposed antenna support structure will not exceed 60.96 meters (200 feet) above ground and does not require notification to the Federal Aviation Administration. Therefore, this structure does not require an Antenna Structure Registration Number.

RF Exposure Calculations
The power density calculations shown below were made using the techniques outlined in OET Bulletin No. 65. "Ground level" calculations in this report have been made at a reference height of 2 meters above ground to provide a worst-case estimate of exposure for persons standing on the ground in the vicinity of the tower. The equation shown below was used to calculate the ground level power density figures from each antenna.

$$S(\mu W / cm^2) = \frac{33.40981 \times AdjERP(Watts)}{D^2}$$

Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

D is the distance in meters from the center of radiation to the calculation point.

Ground level power densities have been calculated for locations extending from the base of the tower to a distance of 1000 meters. Values past this point are increasingly negligible.

Calculations of the power density produced by the proposed translator antenna system have been made using the “worst case” element pattern for a vertical dipole antenna. Under this worst-case assumption, the highest calculated ground level power density from the translator occurs at a distance of 2 meters from the base of the antenna support structure. At this point the power density is calculated to be 49.2 μW/cm².

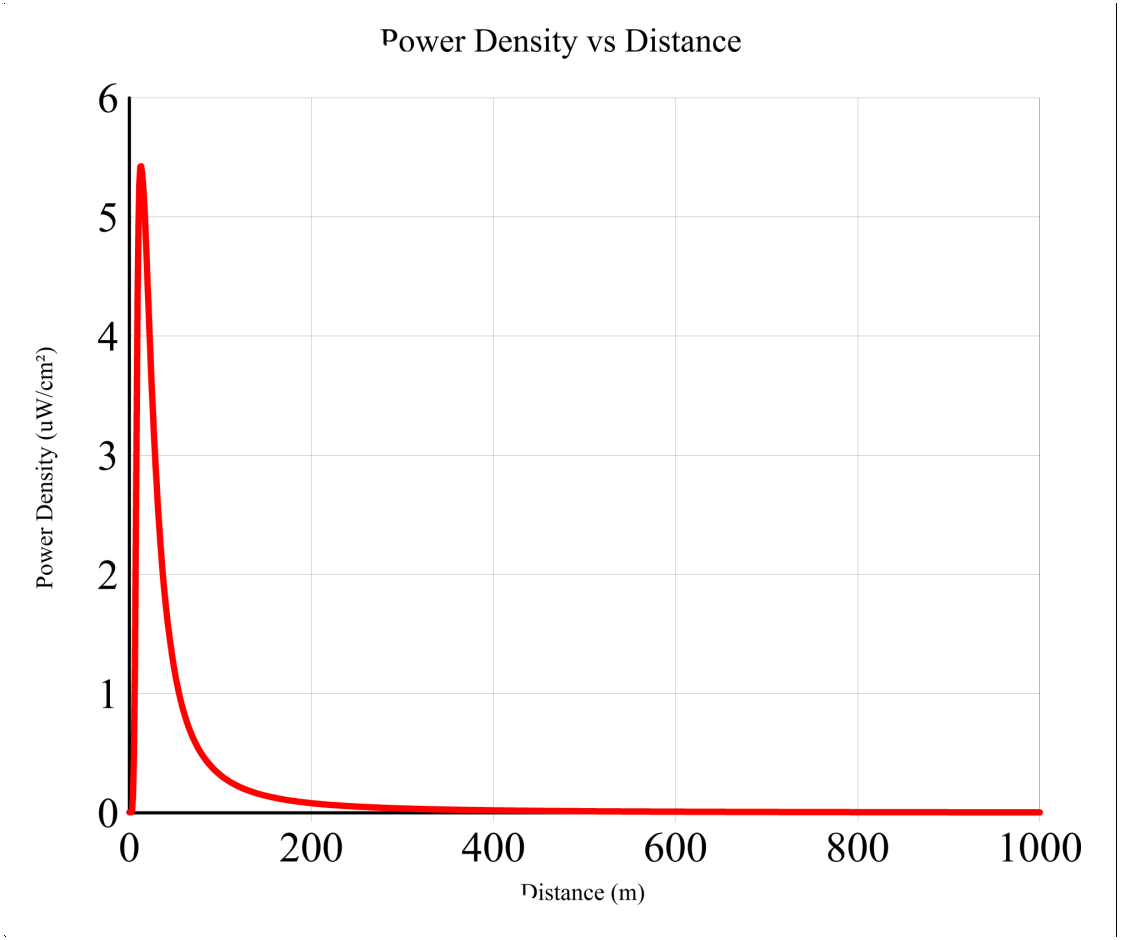
However, the antenna to be used by the translator is not a vertical dipole, and use of the dipole element model dramatically overstates the ground-level power densities produced by this antenna. Included with this Engineering Statement is a complete tabulation of the Scala CL-FMV vertical plane radiation pattern as provided by Scala (the antenna manufacturer) along with the calculated ground-level power density from the antenna at 1 meter increments from the antenna. A sample calculation is provided to demonstrate that these calculations were performed correctly using appropriate mathematical principles and the formula from OET Bulletin No. 65. The

highest calculated ground level power density from the translator occurs at a distance of 13 meters from the base of the antenna support structure. At this point the power density is calculated to be 5.4 μW/cm², which is less than 5% of 200 μW/cm² (the FCC standard for uncontrolled environments).

It is understood that the applicant must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency exposure in excess of FCC guidelines.

K258CN Richland
Ground-Level Power Density Calculations
Using Manufacturer's Vertical Plane Pattern

Antenna	CLFMV			
ERP	0	Watts H (avg)		
	99	Watts V (avg)		
Antenna AGL	10	meters less 2m is	8	meters above the reference plane
Calculated				
Maximum is	5.4	uW/cm² at	13	meters from the tower



Distance From Tower (meters)	Hypotenuse (meters)	Depression Angle (degrees)	Interp Rel Field	Adjusted ERP (watts)	Power Density uW/cm²
0	8.00	90.00	0.010	0.0	0.01
1	8.06	82.87	0.010	0.0	0.01
2	8.25	75.96	0.010	0.0	0.00
3	8.54	69.44	0.023	0.1	0.02
4	8.94	63.43	0.058	0.3	0.14
5	9.43	57.99	0.113	1.3	0.48
6	10.00	53.13	0.191	3.6	1.20
7	10.63	48.81	0.276	7.5	2.23
8	11.31	45.00	0.360	12.8	3.35
9	12.04	41.63	0.434	18.7	4.30
10	12.81	38.66	0.494	24.2	4.93
11	13.60	36.03	0.543	29.2	5.28
12	14.42	33.69	0.584	33.8	5.42
13	15.26	31.61	0.618	37.8	5.43
14	16.12	29.74	0.650	41.8	5.37
15	17.00	28.07	0.680	45.7	5.29
16	17.89	26.57	0.707	49.5	5.16
17	18.79	25.20	0.731	53.0	5.01
18	19.70	23.96	0.753	56.1	4.83
19	20.62	22.83	0.772	59.0	4.64
20	21.54	21.80	0.789	61.7	4.44
21	22.47	20.85	0.805	64.2	4.25
22	23.41	19.98	0.820	66.6	4.06
23	24.35	19.18	0.832	68.6	3.86
24	25.30	18.43	0.843	70.4	3.68
25	26.25	17.74	0.854	72.2	3.50
26	27.20	17.10	0.863	73.8	3.33
27	28.16	16.50	0.872	75.4	3.17
28	29.12	15.95	0.881	76.8	3.03
29	30.08	15.42	0.889	78.2	2.89
30	31.05	14.93	0.896	79.4	2.75
31	32.02	14.47	0.901	80.3	2.62
32	32.98	14.04	0.906	81.2	2.49
33	33.96	13.63	0.910	82.0	2.38
34	34.93	13.24	0.914	82.8	2.27
35	35.90	12.88	0.918	83.5	2.16
36	36.88	12.53	0.922	84.2	2.07
37	37.85	12.20	0.926	84.9	1.98
38	38.83	11.89	0.929	85.5	1.89
39	39.81	11.59	0.932	86.1	1.81
40	40.79	11.31	0.936	86.7	1.74

Sample Calculation for Single Scala CL-FMV antenna

At 13 meters from the base of the antenna support structure, the slant distance to a point 2 meters above ground level is 15.26 meters. This is determined by simple trigonometry, determining the length of the hypotenuse for a right triangle which is 13 meters along the base and 8 meters in height (8 meters being 2 meters less than the antenna height above ground level):

$$a^2 + b^2 = c^2$$

$$13^2 + 8^2 = c^2$$

$$c = 15.26 \text{ meters} = \text{hypotenuse}$$

The corresponding depression angle is identical to the angle between the base and hypotenuse, and is determined here as the inverse of the sine of the height over the hypotenuse of the right triangle:

$$\sin(\text{angle}) = \text{opposite} / \text{hypotenuse}$$

$$\sin(\text{angle}) = 8 / 15.26$$

$$\sin(\text{angle}) = 0.530$$

$$\text{angle} = 31.61 \text{ degrees}$$

From the vertical plane pattern tabulation for the Scala CL-FMV antenna, the relative field value at a depression angle of 31 degrees is 0.628, and at a depression angle of 32 degrees is 0.612. Interpolating between these two, we arrive at a relative field value of 0.618 at a depression angle of 31.61 degrees. We use this relative field value to arrive at the adjusted ERP in watts at the depression angle:

$$\text{adjusted ERP} = (\text{watts H} + \text{watts V}) (\text{relative field squared})$$

$$\text{adjusted ERP} = (0 + 99) (0.618^2)$$

$$\text{adjusted ERP} = 37.8 \text{ watts}$$

By plugging this value into the formula from OET Bulletin 65, we arrive at the calculated ground-level power density:

$$S(\mu W / cm^2) = \frac{33.40981 \times AdjERP(Watts)}{D^2}$$

Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

D is the distance in meters from the center of radiation to the calculation point.

Thus, for an adjusted ERP of 37.8 watts and a slant distance of 15.26 meters, S is calculated to equal 5.4 μW/cm².

Vertical Plane Radiation Pattern for Scala CL-FMV Antenna
Downloaded from Kathrein Scala Pattern & Download Library

Dep Angle	Relative Field
0	1
1	0.996
2	0.992
3	0.988
4	0.984
5	0.98
6	0.974
7	0.968
8	0.962
9	0.956
10	0.95
11	0.939
12	0.928
13	0.917
14	0.906
15	0.895
16	0.88
17	0.865
18	0.85
19	0.835
20	0.82
21	0.803
22	0.786
23	0.769
24	0.752
25	0.735
26	0.717
27	0.699
28	0.681
29	0.663
30	0.645
31	0.628
32	0.612
33	0.595
34	0.579
35	0.563
36	0.544
37	0.525
38	0.507
39	0.488
40	0.47
41	0.448
42	0.426
43	0.404
44	0.382
45	0.36
46	0.338
47	0.316
48	0.294
49	0.272
50	0.25
51	0.231
52	0.212
53	0.193
54	0.174
55	0.155
56	0.141
57	0.127
58	0.113
59	0.099
60	0.085
61	0.077
62	0.069
63	0.061
64	0.053
65	0.045
66	0.04
67	0.035
68	0.03
69	0.025
70	0.02
71	0.018
72	0.016
73	0.014
74	0.012
75	0.01
76	0.01
77	0.01
78	0.01
79	0.01
80	0.01
81	0.01
82	0.01
83	0.01
84	0.01
85	0.01
86	0.01
87	0.01
88	0.01
89	0.01
90	0.01