January 2016
FM Translator K234BU
Spokane, Washington Channel 243D
Allocation Study

250 Mile Window Application
This application is being filed as a "250 Mile Window Application" to modify an authorized FM translator for use with an AM station.

AM Station Callsign: KTRW 630 kHz Opportunity, WA
AM Station Class: D

Translator Distance: 174 kilometers

The translator is licensed to Read Broadcasting LLC. The AM station is licensed to Mutual Broadcasting System LLC. These two entities are under the common control of Thomas Read, who is the sole member and manager of each entity. So while the applicant is not the licensee of the AM station, the applicant has a retransmission agreement with the primary station licensee.

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.

KIIX-FM 241C Opportunity
The proposed translator transmitter site is located within the 60 dBu protected contour of second-adjacent channel station KIIX-FM 241C Opportunity. The following calculation, performed using the *Living Way* methodology, demonstrates interference protection to that station.

Protected Station	Distance & Bearing to Proposal	Station ERP and HAAT on that azimuth	Station Field Strength at Proposal	Corresponding Translator Interfering Contour	Distance to Translator Interfering Contour
KIIX-FM 241C Opportunity	23.41 km 306 deg True	60 kW 911 meters	92.86 dBu F(50,50)	132.86 dBu	25 meters Free Space

The attached map of the proposed transmitter site depicts the 25 meter radius from the proposed facility. There is no population within this contour. Therefore, the proposed facility is believed to satisfy the requirements of §74.1204(d) with respect to KIIX-FM.

KEZE 245C2 Spokane
The proposed translator transmitter site is located within the 60 dBu protected contour of second-adjacent channel station KEZE 245C2 Spokane. The following calculation, performed using the

Living Way methodology, demonstrates interference protection to that station.

Protected Station	**Distance & Bearing to Proposal**	**Station ERP and HAAT on that azimuth**	**Station Field Strength at Proposal**	**Corresponding Translator Interfering Contour**	**Distance to Translator Interfering Contour**
KEZE 245C2 Spokane	12.93 km 114 deg True	8.2 kW 362 meters	86.47 dBu F(50,50)	126.47 dBu	53 meters Free Space

The attached map of the proposed transmitter site depicts the 53 meter radius from the proposed facility. There is no population within this contour. Therefore, the proposed facility is believed to satisfy the requirements of §74.1204(d) with respect to KEZE.

The attached spacing study demonstrates compliance with §73.207 of the Commission's Rules regarding spacing restrictions to stations which are 53 or 54 channels removed from the proposed operation.

FMSTUDY.EXE Copyright 2013, Hatfield & Dawson, LLC Version 1.82

SEARCH PARAMETERS FM Database Date: 151230

Channel: 243A 96.5 MHz

Latitude: 47 41 39

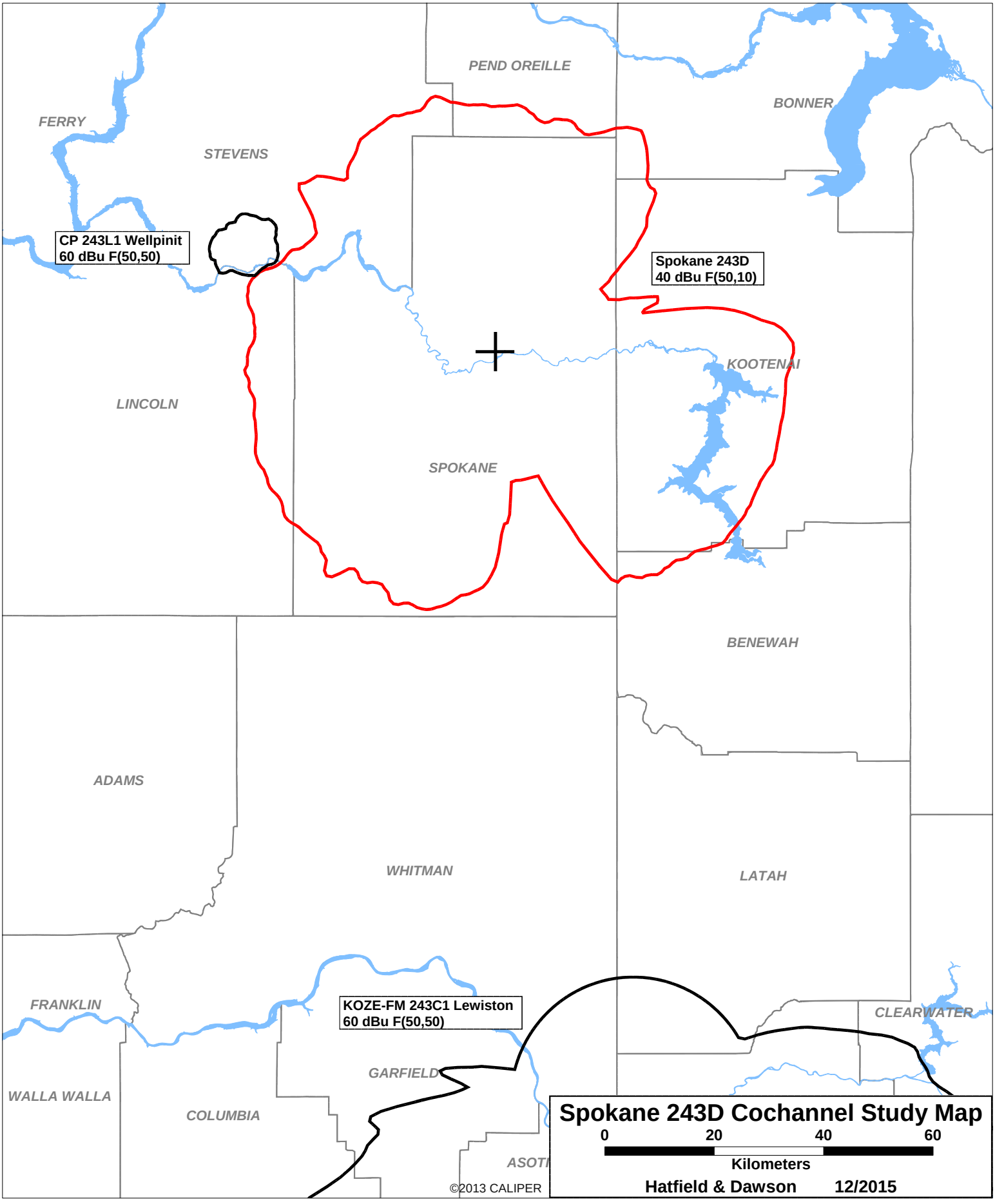
Longitude: 117 20 3

Safety Zone: 50 km

Job Title: BEACON HILL 243

Call Status	City St	FCC File No.	Channel Freq.	ERP(kW) HAAT(m)		Latitude Longitude	Bearing deg-True	Dist (km)	Req (km)
KIIXaux	OPPORTUNITY		241C	1.000		47-34-13	126.1	23.35	0
LIC	WA	BXLH-80124ACS	96.1	736.0		117-05-00		0.00	AUX
KIIX-FM	OPPORTUNITY		241C	60.000		47-34-14	125.9	23.41	95
LIC	WA	BMLH-41112AIN	96.1	744.0		117-04-55		-71.59	SHORT
	CRANBROOK		243C	0.000		49-27-30	32.0	233.06	247
	BC	-	96.5	0.0		115-37-45		-13.94	SHORT
KOZE-FM	LEWISTON		243C1	25.000		46-27-48	169.4	139.16	200
LIC	ID	BLH-901128KC	96.5	226.0		117-00-01		-60.84	SHORT
NEW	WELLPINIT		243L1	0.002		47-52-26	293.8	50.00	67
CP	WA	BNPL-31113BHW	96.5	241.1		117-56-45		-17.00	SHORT
KEZE	SPOKANE		245C2	8.200	DA	47-43-33	74.1	12.93	55
LIC	WA	BLH-01120AAJ	96.9	365.0		117-10-06		-42.07	SHORT
KEZEaux	SPOKANE		245C2	1.900		47-37-43	167.9	7.45	0
LIC	WA	BXLH-81117ADU	96.9	164.0		117-18-48		0.00	AUX
KPKL	DEER PARK		296C3	25.000		48-01-45	332.1	42.20	12
LIC	WA	BLH-40929AND	107.1	100.0		117-35-57		30.20	CLEAR
KPKL-FM1	SPOKANE		296D	5.000	DA	47-38-37	241.1	11.65	10
LIC	WA	BLFTB-21105AKF	107.1	16.0		117-28-12		1.65	CLEAR

==== END OF FM SPACING STUDY FOR CHANNEL 243 ====


PEND OREILLE
BONNER
FERRY
STEVENS
CP 243L1 Wellpinit
60 dBu F(50,50)
Spokane 243D
40 dBu F(50,10)
KOOTENAI
LINCOLN
SPOKANE
BENEWAH
ADAMS
WHITMAN
LATAH
FRANKLIN
KOZE-FM 243C1 Lewiston
60 dBu F(50,50)
CLEARWATER
GARFIELD
WALLA WALLA
COLUMBIA
ASOTI
©2013 CALIPER
Spokane 243D Cochannel Study Map
0
20
40
60
Kilometers
Hatfield & Dawson 12/2015

January 2016
FM Translator K234BU
Spokane, Washington Channel 243D
RF Exposure Study

Facilities Proposed
The proposed operation will be on Channel 243D (96.5 MHz) with a maximum lobe effective radiated power of 250 watts. Operation is proposed with an antenna to be mounted on an existing pole on Beacon Hill, currently used by KSPO(FM).

The Antenna Structure Registration Number is 1200038.

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.

The antenna to be used by the translator is a Scala FMV dipole. Included with this Engineering Statement is a complete tabulation of the Scala 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 9 meters from the base of the antenna support structure. At this point the power density is calculated to be 29.7 μW/cm², which is 14.9% of 200 μW/cm² (the FCC standard for uncontrolled environments).

Calculations of the power density produced by the translator and the other stations at this transmitter site are summarized in the following table:

Call	Avg or Peak ERP Antenna Model	Relative Field	Height AGL	Calculated Max Exposure	Gen Pub FCC Limit	% of Limit
Spokane 243D	0.250 kW V Scala FMV	see calculation	9 m	29.7 μW/cm²	200 μW/cm²	14.9%
KSPO 293A	2.25 kW H 2.25 kW V JAM 4-bay halfwave	FMModel	15 m	24.2 μW/cm²	200 μW/cm²	12.1%
KKSN-LP 268L1	0.003 kW H 0.003 kW V 1-bay ring stub assumed	FMModel	15 m	0.7 μW/cm²	200 μW/cm²	0.4%
KDYS-LD Ch32	12.3 kW H ERI AL8	0.125	19 m	22.2 μW/cm²	385 μW/cm²	5.8%

(For TV translators, the relative field value indicated is the maximum value which occurs at 45 degrees or more below the horizontal, based on the manufacturer's vertical plane pattern. The resulting adjusted ERP value is assumed to be radiated straight down to a point 2 meters above ground level at the base of the tower.)

These calculations show that the maximum calculated power density produced at two meters above ground level by the proposed operation of the translator and the present operation of the other stations at this site (were their maxima to coincide, which they do not) is 33.2% of the FCC standard for uncontrolled environments.

The permittee/licensee in coordination with other users of the site 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.

Sample Calculation for Single Scala FMV antenna

At 9 meters from the base of the antenna support structure, the slant distance from the antenna to a point 2 meters above ground level is 11.40 meters. This is determined by simple trigonometry, determining the length of the hypotenuse for a right triangle which is 9 meters along the base and 7 meters in height (7 meters being the antenna height above ground, less 2 meters):

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

$$9^2 + 7^2 = c^2$$

$$c = 11.40 \text{ meters} = \text{hypotenuse}$$

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:

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

$$\sin(\text{angle}) = 7 / 11.40$$

$$\sin(\text{angle}) = 0.614$$

$$\text{angle} = 37.87 \text{ degrees}$$

From the vertical plane pattern tabulation for the Scala FMV antenna, the relative field value at a depression angle of 37 degrees is 0.695, and at a depression angle of 38 degrees is 0.678. Interpolating between these two, we arrive at a relative field value of 0.680 at a depression angle of 37.87 degrees. We use this relative field value to arrive at the adjusted ERP in watts at the depression angle:

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

$$\text{adjusted ERP} = (0 + 250)(0.680^2)$$

$$\text{adjusted ERP} = 115.6 \text{ watts}$$

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.

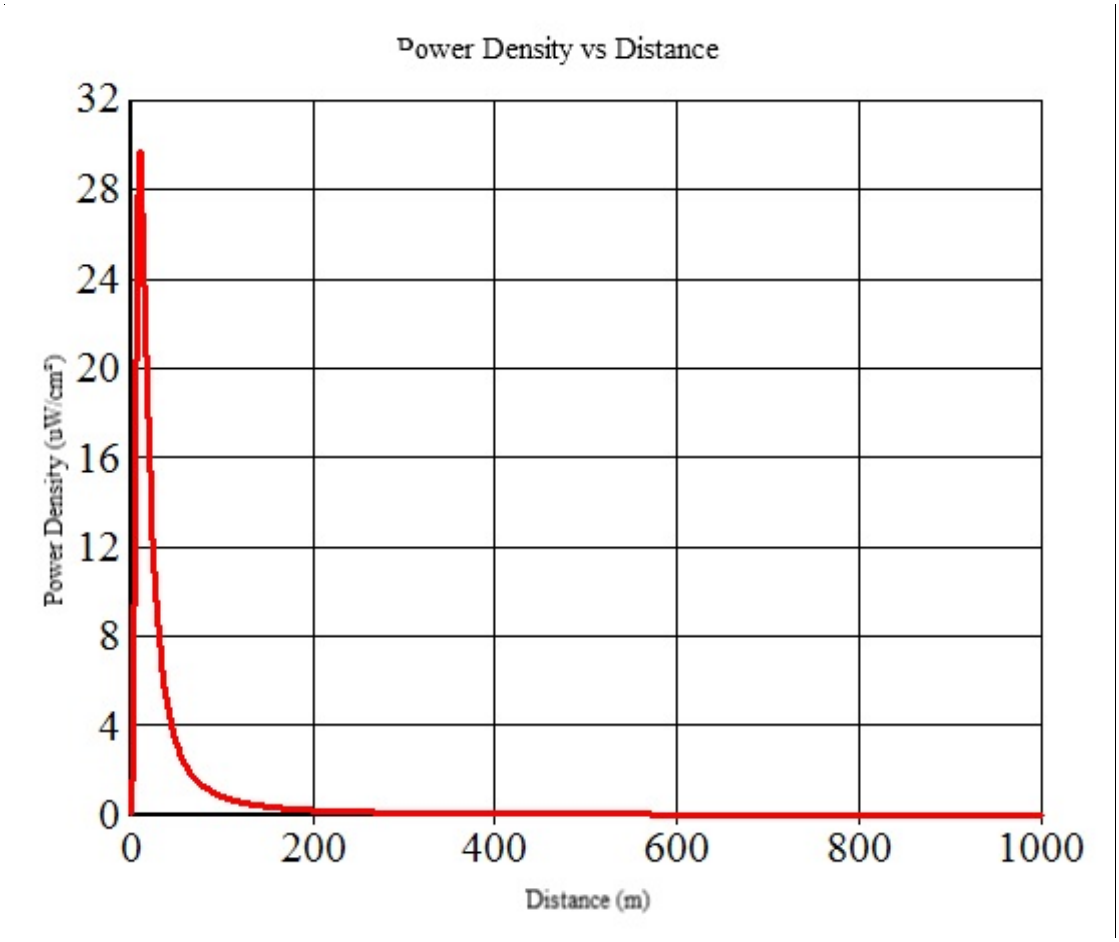
Thus, for an adjusted ERP of 115.6 watts and a slant distance of 11.40 meters, S is calculated to equal 29.7 μW/cm².

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

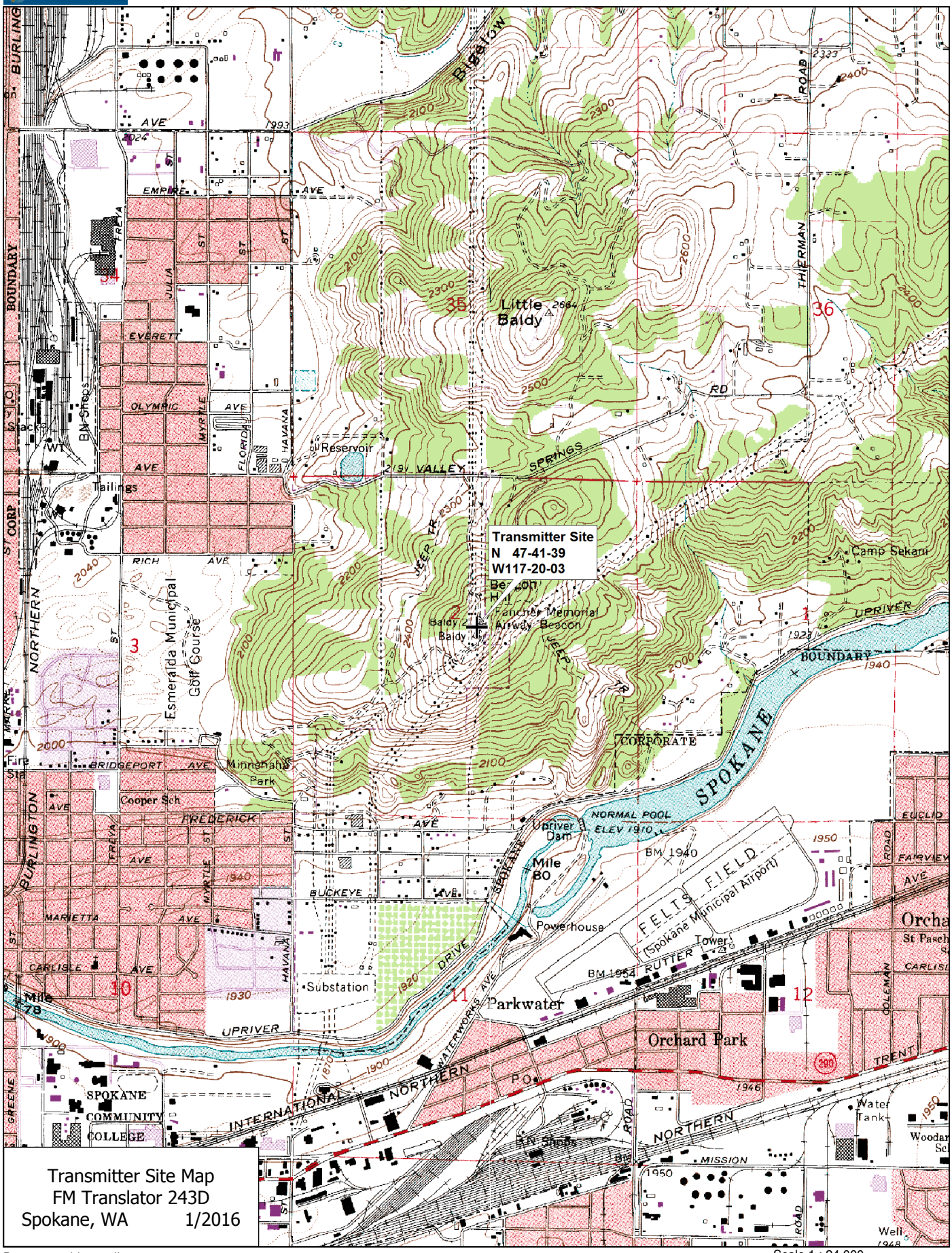
Depression Angle	Relative Field
0	1.000
1	0.999
2	0.999
3	0.998
4	0.997
5	0.995
6	0.993
7	0.991
8	0.989
9	0.985
10	0.982
11	0.977
12	0.973
13	0.967
14	0.962
15	0.956
16	0.95
17	0.942
18	0.935
19	0.927
20	0.918
21	0.909
22	0.899
23	0.889
24	0.878
25	0.867
26	0.855
27	0.842
28	0.83
29	0.816
30	0.803
31	0.788
32	0.774
33	0.758
34	0.743
35	0.727
36	0.711
37	0.695
38	0.678
39	0.662
40	0.645
41	0.628
42	0.61
43	0.593
44	0.575
45	0.558
46	0.541
47	0.523
48	0.506
49	0.489
50	0.472
51	0.455
52	0.438
53	0.421
54	0.404
55	0.388
56	0.372
57	0.356
58	0.341
59	0.326
60	0.31
61	0.296
62	0.282
63	0.268
64	0.254
65	0.24
66	0.226
67	0.214
68	0.201
69	0.188
70	0.176
71	0.164
72	0.152
73	0.141
74	0.13
75	0.119
76	0.108
77	0.098
78	0.087
79	0.077
80	0.067
81	0.057
82	0.047
83	0.038
84	0.028
85	0.019
86	0.01
87	0.01
88	0.01
89	0.017
90	0.025

Spokane 243D
Ground-Level Power Density Calculations
Using Manufacturer's Vertical Plane Pattern

Antenna	FMV			
ERP	0	Watts H (avg)		
	250	Watts V (avg)		
Antenna AGL	9	meters less 2m is	7	meters above the reference plane
Calculated				
Maximum is	29.72	uW/cm² at	9	meters from the tower



Distance From Tower (meters)	Hypotenuse (meters)	Depression Angle (degrees)	Interp Rel Field	Adjusted ERP (watts)	Power Density uW/cm²
0	7.00	90.00	0.025	0.2	0.11
1	7.07	81.87	0.048	0.6	0.39
2	7.28	74.05	0.129	4.2	2.64
3	7.62	66.80	0.216	11.7	6.74
4	8.06	60.26	0.306	23.5	12.07
5	8.60	54.46	0.397	39.3	17.75
6	9.22	49.40	0.482	58.1	22.85
7	9.90	45.00	0.558	77.8	26.54
8	10.63	41.19	0.625	97.5	28.84
9	11.40	37.87	0.680	115.6	29.72
10	12.21	34.99	0.727	132.2	29.64
11	13.04	32.47	0.766	146.9	28.86
12	13.89	30.26	0.799	159.7	27.64
13	14.76	28.30	0.826	170.5	26.13



Transmitter Site Map
FM Translator 243D
Spokane, WA 1/2016

TN
MN (14.6°E)

Scale 1 : 24,000

0 600 1200 1800 2400 3000 ft
0 200 400 600 800 1000 m

1 cm = 240.0 m Data Zoom 13-1