March 2015
KKIQ(FM) Channel 269A
Livermore, California
Auxiliary Antenna Engineering

Facilities Proposed

The proposed auxiliary antenna operation will be on Channel 269A (101.7 MHz) with an effective radiated power of 2.45 kilowatts. Operation is proposed with a 2-element circularly-polarized omni-directional antenna, mounted on a wooden pole atop Cedar Mountain. The main KKDV antenna is installed on an adjacent wooden pole located at the same whole-second geographic coordinates. The main and auxiliary antennas will be at the same height on the adjacent poles.

The antenna support structure does 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.

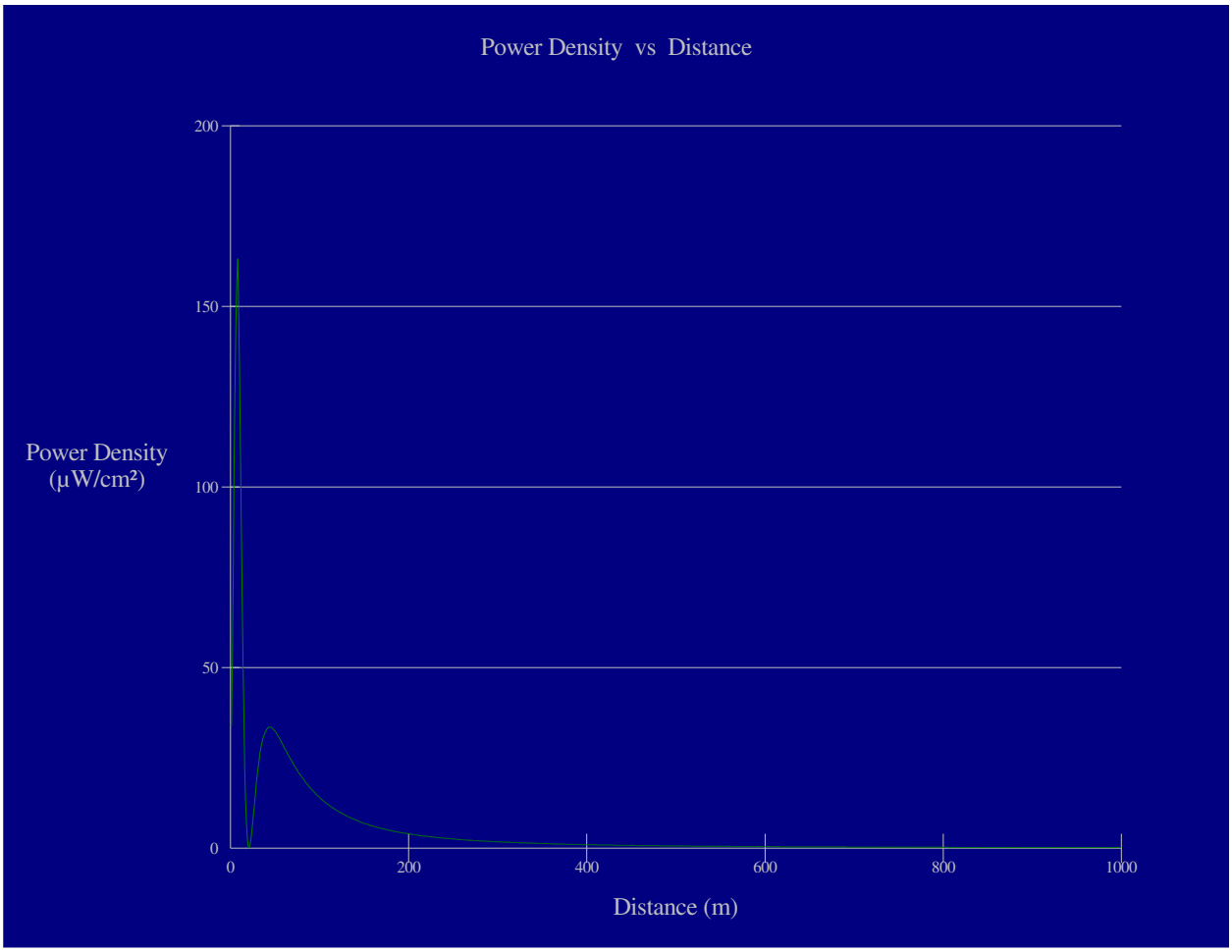
Calculations of the power density produced by the KKIQ auxiliary antenna system assume a Type 3 element pattern, which is the element pattern for the ERI LPX-2E antenna which will be used by

the station. The highest calculated ground level power density occurs at a distance of 8 meters from the base of the antenna support structure. At this point the power density is calculated to be 163.3 $\mu W/cm^2$.

FM translator K211EZ is also located at this site. Calculations of the power density produced by the K211EZ antenna system have been made using the manufacturer's vertical plane pattern for the single Scala CA2-CP antenna which is used by that station. 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 2 meters from the base of the antenna support structure. At this point the power density is calculated to be 35.0 $\mu W/cm^2$.

These calculations show that the maximum calculated power density produced at two meters above ground level by the proposed operation of KKIQ auxiliary and the present operation of K211EZ is 198.3 $\mu W/cm^2$, which does not exceed 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.



Ground-Level RF Exposure **OET FMModel**

KKIQ 269A Livermore (Auxiliary)

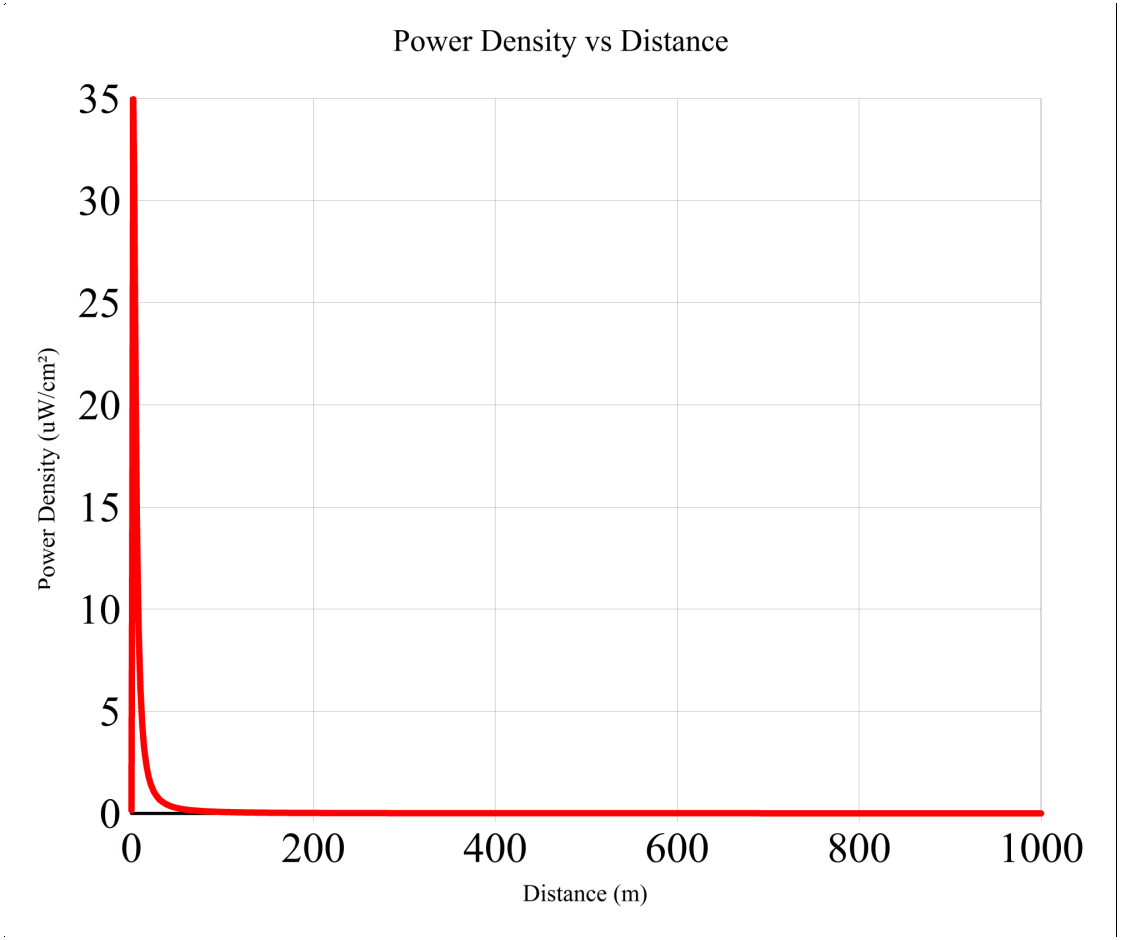
Antenna Type:	ERI LPX-2E “rototiller”
No. of Elements:	2
Element Spacing:	1.0 wavelength
Distance:	1000 meters
Horizontal ERP:	2.450 kW
Vertical ERP:	2.450 kW
Antenna Height:	14 meters AGL

Maximum Calculated Power Density is 163.3 µW/cm^2 at 8 meters from the antenna structure.

K211EZ Livermore
Ground-Level Power Density Calculations
Using Manufacturer's Vertical Plane Pattern

Antenna	CA2CP			
ERP	10	Watts H (avg)		
	10	Watts V (avg)		
Antenna AGL	4	meters less 2m is	2	meters above the reference plane

Calculated				
Maximum is	34.96	uW/cm² at	2	meters from the tower



Distance From Tower (meters)	Hypotenuse (meters)	Depression Angle (degrees)	Interp Rel Field	Adjusted ERP (watts)	Power Density uW/cm²
0	2.00	90.00	0.030	0.0	0.15
1	2.24	63.43	0.322	2.1	13.83
2	2.83	45.00	0.647	8.4	34.96
3	3.61	33.69	0.787	12.4	31.81
4	4.47	26.57	0.862	14.9	24.82
5	5.39	21.80	0.905	16.4	18.85
6	6.32	18.43	0.930	17.3	14.46
7	7.28	15.95	0.946	17.9	11.29
8	8.25	14.04	0.958	18.3	9.01
9	9.22	12.53	0.966	18.7	7.33
10	10.20	11.31	0.972	18.9	6.08
11	11.18	10.30	0.977	19.1	5.11
12	12.17	9.46	0.980	19.2	4.34
13	13.15	8.75	0.982	19.3	3.72
14	14.14	8.13	0.984	19.3	3.23
15	15.13	7.59	0.985	19.4	2.83
16	16.12	7.13	0.986	19.4	2.50
17	17.12	6.71	0.987	19.5	2.22
18	18.11	6.34	0.987	19.5	1.99
19	19.10	6.01	0.988	19.5	1.79
20	20.10	5.71	0.989	19.5	1.62
21	21.10	5.44	0.989	19.6	1.47
22	22.09	5.19	0.990	19.6	1.34
23	23.09	4.97	0.990	19.6	1.23
24	24.08	4.76	0.990	19.6	1.13
25	25.08	4.57	0.991	19.6	1.04
26	26.08	4.40	0.991	19.6	0.97
27	27.07	4.24	0.992	19.7	0.90
28	28.07	4.09	0.992	19.7	0.83
29	29.07	3.95	0.992	19.7	0.78
30	30.07	3.81	0.992	19.7	0.73
31	31.06	3.69	0.993	19.7	0.68
32	32.06	3.58	0.993	19.7	0.64
33	33.06	3.47	0.993	19.7	0.60
34	34.06	3.37	0.993	19.7	0.57
35	35.06	3.27	0.993	19.7	0.54
36	36.06	3.18	0.994	19.7	0.51
37	37.05	3.09	0.994	19.8	0.48
38	38.05	3.01	0.994	19.8	0.46
39	39.05	2.94	0.994	19.8	0.43
40	40.05	2.86	0.994	19.8	0.41
41	41.05	2.79	0.994	19.8	0.39

Sample Calculation for Single Scala CA2-CP antenna

At 2 meters from the base of the antenna support structure, the slant distance to a point 2 meters above ground level is 2.83 meters. This is determined by simple trigonometry, determining the length of the hypotenuse for a right triangle which is 2 meters along the base and 2 meters in height (2 meters being 2 meters less than the studied antenna's height above ground level):

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

$$2^2 + 2^2 = c^2$$

$$c = 2.83 \text{ meters} = \text{hypotenuse}$$

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:

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

$$\sin(\text{angle}) = 2 / 2.83$$

$$\sin(\text{angle}) = 0.707$$

$$\text{angle} = 45.0 \text{ degrees}$$

From the vertical plane pattern tabulation for the Scala CA2-CP antenna, the relative field value at a depression angle of 45 degrees is 0.647. We use this relative field value to arrive at the adjusted ERP in watts at the depression angle:

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

$$\text{adjusted ERP} = (10 + 10)(0.647^2)$$

$$\text{adjusted ERP} = 8.4 \text{ watts}$$

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

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

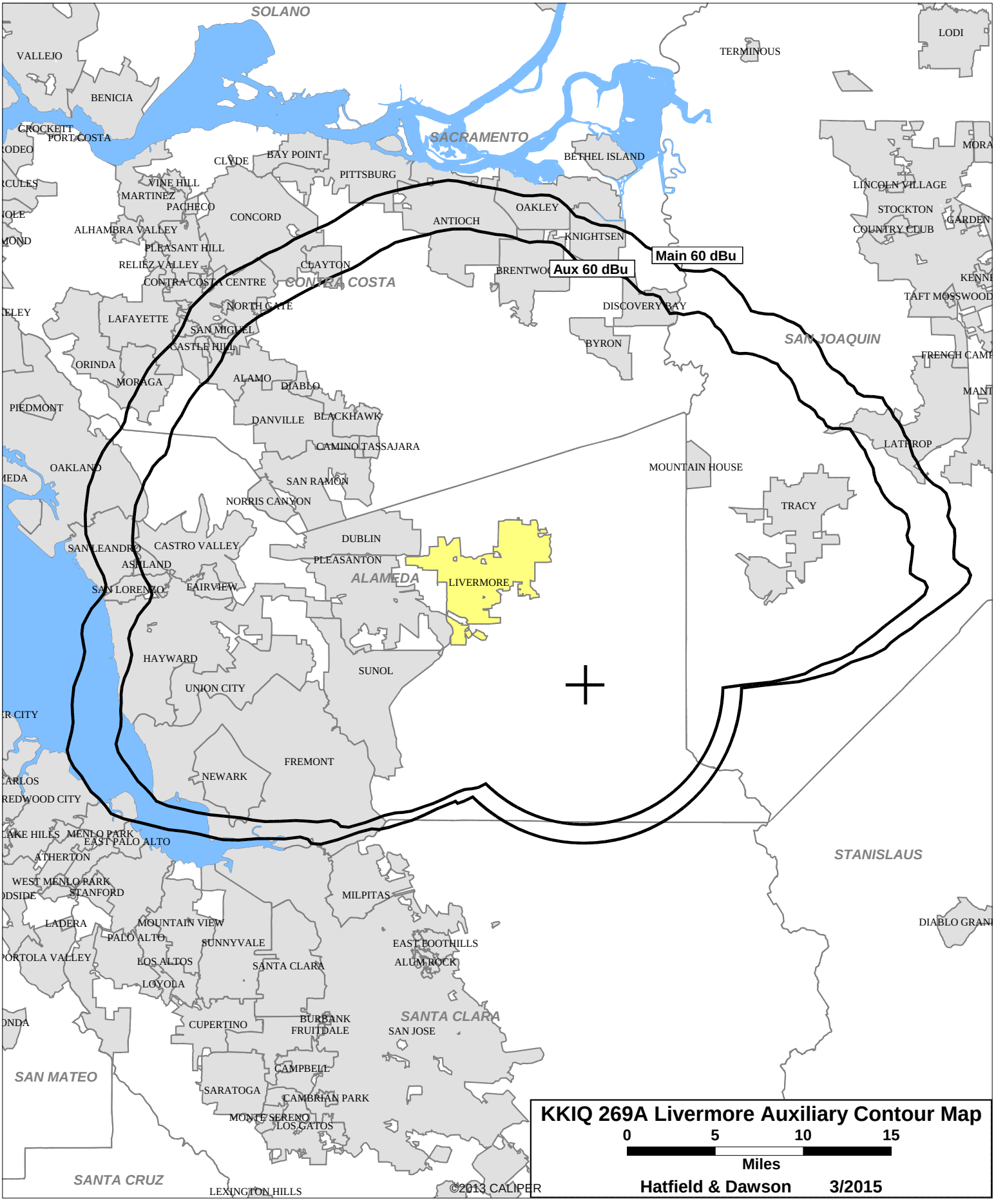
Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

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

Thus, for an adjusted ERP of 8.4 watts and a slant distance of 2.83 meters, S is calculated to equal 35.0 µW/cm².

Vertical Plane Radiation Pattern for Scala CA2-CP Antenna

Depression Angle	Relative Field
0	1.000
1	0.998
2	0.996
3	0.994
4	0.992
5	0.990
6	0.988
7	0.986
8	0.984
9	0.981
10	0.979
11	0.974
12	0.969
13	0.963
14	0.958
15	0.952
16	0.946
17	0.939
18	0.933
19	0.927
20	0.920
21	0.911
22	0.903
23	0.894
24	0.885
25	0.877
26	0.867
27	0.858
28	0.848
29	0.839
30	0.829
31	0.818
32	0.806
33	0.795
34	0.783
35	0.772
36	0.760
37	0.749
38	0.738
39	0.726
40	0.715
41	0.701
42	0.688
43	0.674
44	0.660
45	0.647
46	0.631
47	0.616
48	0.601
49	0.585
50	0.570
51	0.553
52	0.537
53	0.520
54	0.503
55	0.487
56	0.467
57	0.447
58	0.428
59	0.408
60	0.388
61	0.369
62	0.350
63	0.330
64	0.311
65	0.292
66	0.271
67	0.250
68	0.229
69	0.208
70	0.187
71	0.168
72	0.150
73	0.132
74	0.113
75	0.095
76	0.085
77	0.075
78	0.065
79	0.055
80	0.045
81	0.042
82	0.040
83	0.037
84	0.034
85	0.032
86	0.031
87	0.031
88	0.031
89	0.030
90	0.030


SOLANO
VALLEJO
BENICIA
CROCKETT
PORT COSTA
SACRAMENTO
TERMINOUS
LODI
BETHEL ISLAND
CLYDE
BAY POINT
PITTSBURG
VINE HILL
MARTINEZ
PACHECO
CONCORD
ANTIOCH
OAKLEY
LINCOLN VILLAGE
STOCKTON
COUNTRY CLUB
ALHAMBRA VALLEY
PLEASANT HILL
KNIGHTSEN
RELIEZ VALLEY
CLAYTON
BRENTWOOD
Main 60 dBu
Aux 60 dBu
CONTRA COSTA
CONTRA COSTA CENTRE
NORTH GATE
DISCOVERY BAY
LAFAYETTE
SAN MIGUEL
CASTLE HILL
BYRON
SAN JOAQUIN
ORINDA
MORAGA
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OAKLAND
SAN RAMON
MOUNTAIN HOUSE
NORRIS CANYON
TRACY
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SAN LEANDRO
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ASHLAND
ALAMEDA
LIVERMORE
SAN LORENZO
FAIRVIEW
HAYWARD
SUNOL
UNION CITY
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NEWARK
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ATHERTON
STANISLAUS
WEST MENLO PARK
STANFORD
MILPITAS
LADERA
MOUNTAIN VIEW
PALO ALTO
SUNNYVALE
EAST FOOTHILLS
LOS ALTOS
SANTA CLARA
ALUM ROCK
LOYOLA
SANTA CLARA
CUPERTINO
BURBANK
FRUITDALE
SAN JOSE
CAMPBELL
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SARATOGA
CAMBRIAN PARK
MONTE SERENO
LOS GATOS
SANTA CRUZ
LEXINGTON HILLS
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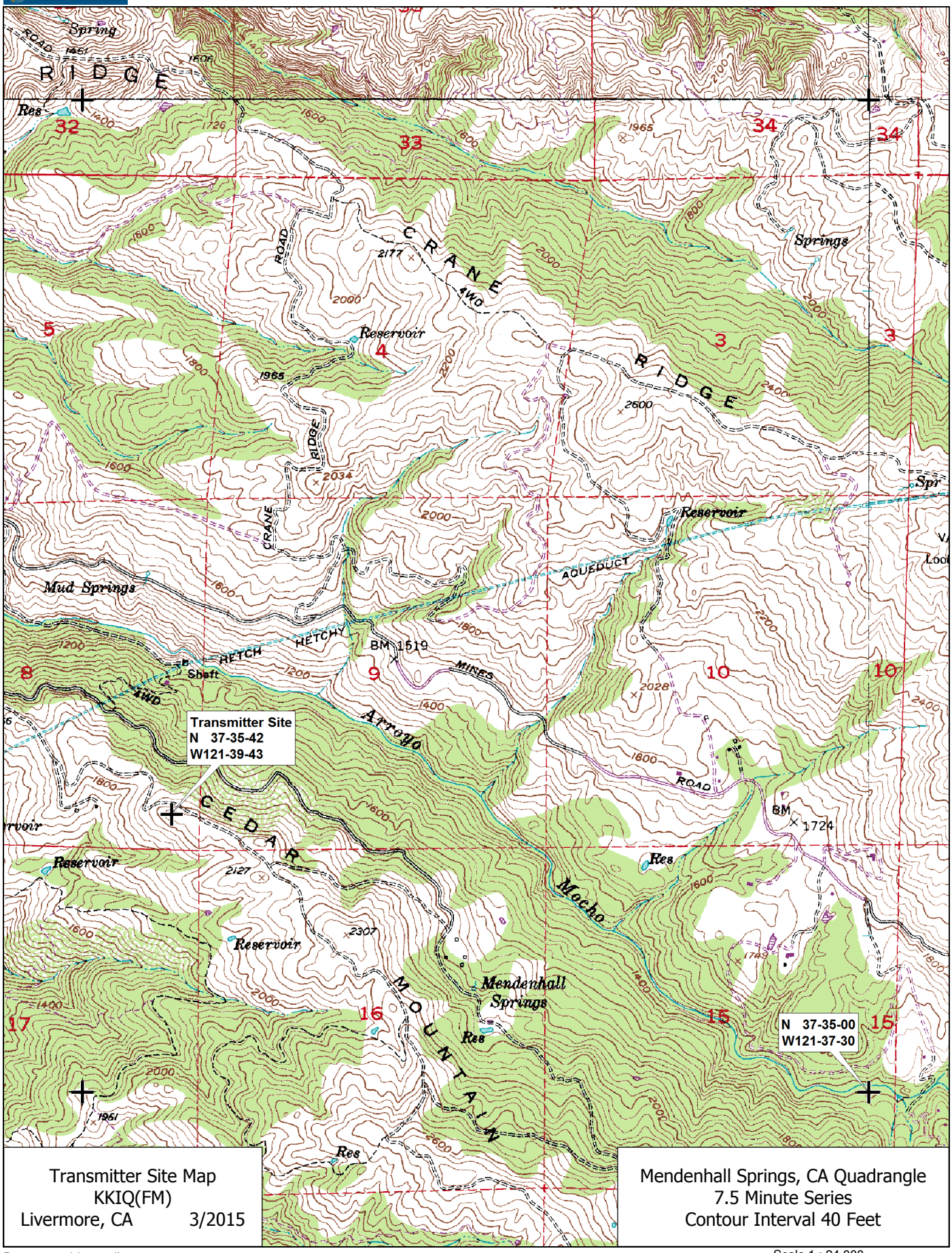
KKIQ 269A Livermore Auxiliary Contour Map
0 5 10 15
Miles
Hatfield & Dawson 3/2015



Transmitter Site Map
KKIQ(FM)
Livermore, CA 3/2015

Mendenhall Springs, CA Quadrangle
7.5 Minute Series
Contour Interval 40 Feet

TN
MN (13.6°E)

Scale 1 : 24,000
1 cm = 240.0 m Data Zoom 13-1