

## **Sutro Tower, Inc. • San Francisco, California**

### **Statement of Hammett & Edison, Inc., Consulting Engineers**

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained by Sutro Tower, Inc. to evaluate RF exposure levels near the Sutro Tower broadcast site, 1 La Avanzada Street, San Francisco, California, for compliance with appropriate guidelines limiting human exposure to radio frequency electromagnetic fields.

### **Background Information**

Sutro Tower is located near Mt. Sutro in San Francisco, California, and currently supports the transmitting facilities for twelve DTV stations and three FM stations. As part of the final DTV antenna installation project, Sutro Tower agreed to provide the neighborhood associations with measurement data of existing RF exposure levels at 200 locations within a 1,000-foot radius of the tower within two weeks of the activation of any new DTV antenna, or within two weeks of any DTV antenna power increase, or every three years, whichever is earliest. KEMO-TV, D32, Santa Rosa, California, recently activated its new DTV antenna from Sutro Tower.

### **Prevailing Exposure Standards**

The U.S. Congress requires that the Federal Communications Commission (“FCC”) evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar exposure limits. A summary of the FCC’s exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

### **Measurement Procedure**

The site was visited by the undersigned engineer and by Mr. Brian Palmer, a qualified engineer employed by Hammett & Edison, Inc., during regular business hours on June 8, 2015, a non-holiday weekday. Measurements were made at 208 locations within a 1,000-foot radius of Sutro Tower, as shown in Figure 2, including all residential streets. Measurements were taken at a typical spacing of

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about 60–75 feet along the streets, although variations occurred due to topography and street layout. Measurements were made using a Narda Type NBM-520 Broadband Field Meter with Type EF-0391 and Type EA-5091 Isotropic Broadband Electric Field Probes (Serial Nos. D-0454 and 01035, respectively). All meters and probes were under current calibration by manufacturer. The Type EF-0391 probe provides results in volts/meter (V/m) and is calibrated for exposure of levels down to 0.2 V/m (0.005% of the most restrictive public limit); measurement results using that instrument are expressed as a percentage of the most restrictive FCC limit (0.2 mW/cm<sup>2</sup>). The Type EA-5091 probe is capable of providing results directly as a percent of the applicable FCC exposure limit. Both probes are broadband devices, which means that they measure all radio frequency sources, not just the broadcast operations at Sutro Tower.

The specifications of the main DTV and FM antennas, as operating during the measurements, are as follows:

Station	Channel	Effective Radiated Power	Antenna Make & Model	Center Height Above Sea Level
KGO-TV	D07	24 kW	Dielectric TCL-6A7-S	544.2 m
KOFY-TV	D19	568	Dielectric TFU-30DSC/VP-R 4C190	519.0
KPIX-TV	D29	1,000	Dielectric TUM-C5SP-14/60H-2-T-R	542.6
KQED	D30	1,000	Dielectric TUM20-C5SP-14/60H-2-R-T	542.6
KEMO-TV	D32	200	RFS RD24-D-578/704-FR	498.2
KMTP-TV	D33	480	Dielectric TUM20-C5SP-14/60H-2-R-T	542.6
KFSF-DT	D34	370	Dielectric TFU-26DSC/VP-R P190	523.7
KRON-TV	D38	1,000	Dielectric TUM-C5SP-14/60H-2-T-R	542.6
KCNS	D39	1,000	Dielectric TUM20-C5SP-14/60H-2-R-T	542.6
KCSM-TV	D43	500	Dielectric TUM20-C5SP-14/60H-2-R-T	542.5
KTVU	D44	1,000	Dielectric TUM-C5SP-14/60H-2-T-R	542.0
KBCW	D45	1,000	Dielectric TFU-19JSC/VP-R CT150 SP	521.4
KOIT(FM)	243	24	ERI SHPX-6AC-HW	511
KSOL(FM)	255	6.1	ERI LPX-3E-SP	440
KFOG(FM)	283	7.1	Harris FMH-2AE-HW	490

### Measurement Results

The maximum RF level measured at any of the 208 locations surrounding Sutro Tower was 7.0% of the most restrictive FCC public exposure limit. A tabulation of measurement results at each of those locations is provided in Figure 3.

### Conclusion

It is my professional opinion that the TV and FM broadcast stations at Sutro Tower continue to comply with prevailing standards for limiting public exposure to radio frequency energy.

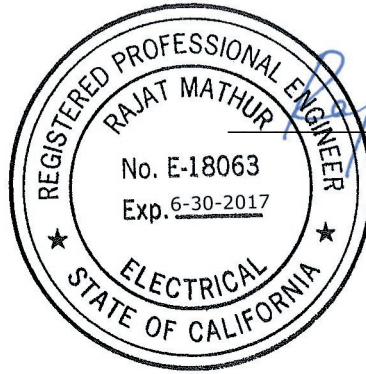
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**Figures**

In carrying out these engineering studies, the following attached figures were prepared under my direct supervision:

1. Summary of FCC RF exposure guidelines
2. Map showing measurement locations
3. Table showing measurement results.

July 9, 2015



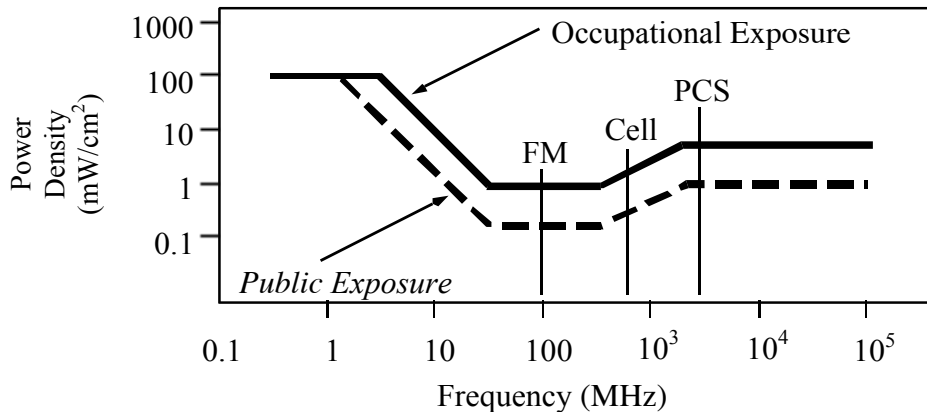
*Rajat Mathur*  
Rajat Mathur, P.E.

## FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

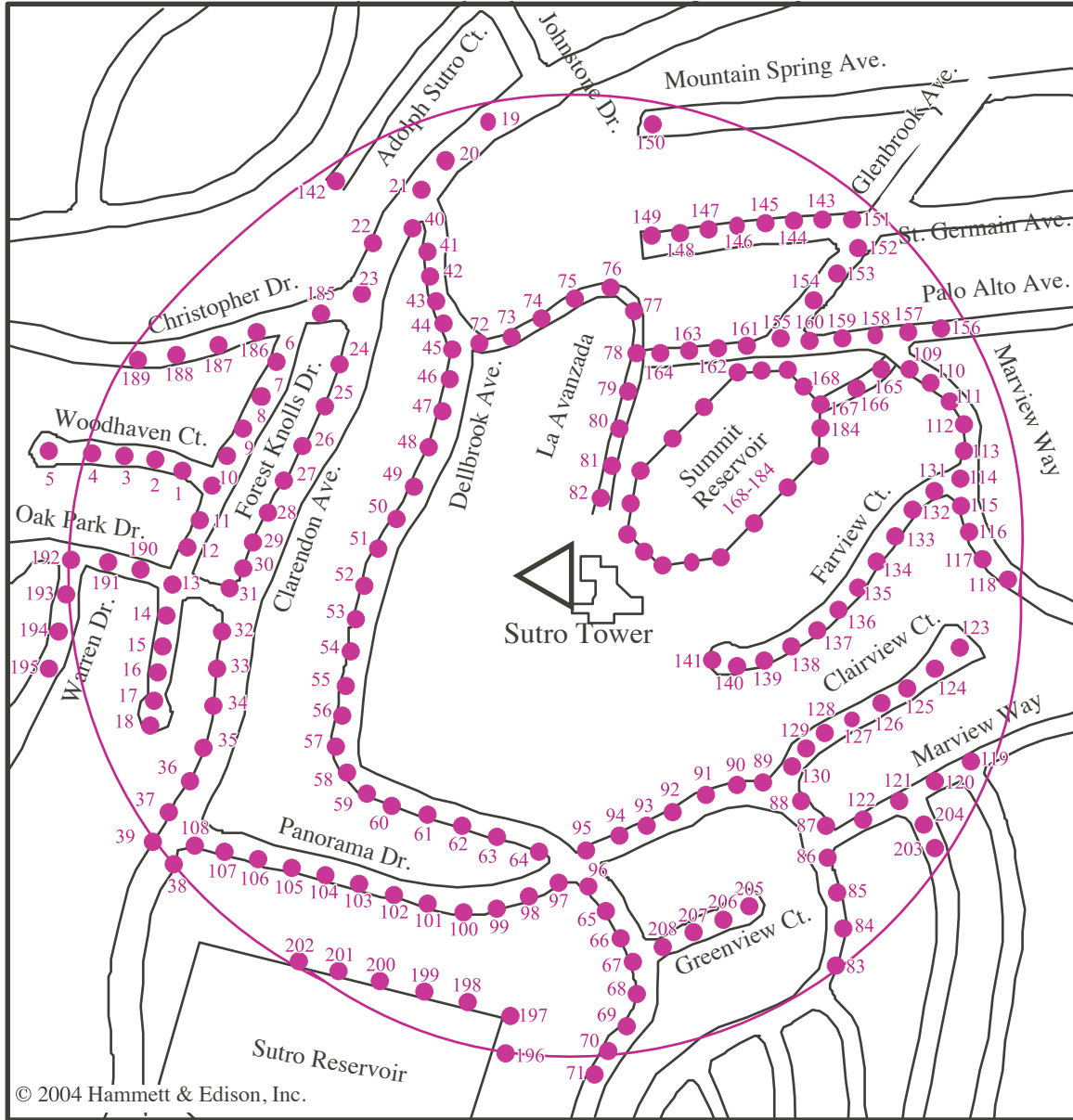
Frequency Applicable Range (MHz)	Electromagnetic Fields (f is frequency of emission in MHz)					
	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm <sup>2</sup> )	
0.3 – 1.34	614	<i>614</i>	1.63	<i>1.63</i>	100	<i>100</i>
1.34 – 3.0	614	<i>823.8/f</i>	1.63	<i>2.19/f</i>	100	<i>180/f<sup>2</sup></i>
3.0 – 30	1842/f	<i>823.8/f</i>	4.89/f	<i>2.19/f</i>	900/f <sup>2</sup>	<i>180/f<sup>2</sup></i>
30 – 300	61.4	<i>27.5</i>	0.163	<i>0.0729</i>	1.0	<i>0.2</i>
300 – 1,500	3.54√f	<i>1.59√f</i>	√f/106	<i>√f/238</i>	f/300	<i>f/1500</i>
1,500 – 100,000	137	<i>61.4</i>	0.364	<i>0.163</i>	5.0	<i>1.0</i>



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.



Measurement Locations



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**Purple circle** represents 1000-foot radius from Sutro Tower.  
**Purple dots** denote locations for measurement results in Figure 3.

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Measured Power Density Levels  
June 8, 2015

Location	Percent FCC Limit*	Location	Percent FCC Limit*	Location	Percent FCC Limit*
1	1.6	41	1.8	81	1.8
2	1.0	42	1.7	82	0.70
3	0.83	43	1.1	83	0.53
4	0.53	44	1.8	84	0.58
5	0.48	45	1.4	85	0.76
6	2.1	46	2.3	86	1.2
7	2.0	47	1.1	87	1.6
8	1.4	48	0.90	88	3.4
9	1.4	49	0.76	89	4.6
10	1.3	50	0.83	90	5.5†
11	1.3	51	1.2	91	5.0†
12	0.83	52	1.6	92	6.0†
13	0.58	53	1.5	93	5.6
14	0.43	54	0.70	94	4.3
15	0.58	55	0.90	95	4.2
16	0.53	56	1.0	96	2.1
17	0.38	57	2.3	97	2.6
18	0.58	58	2.5	98	1.4
19	0.26	59	2.0	99	2.3
20	0.22	60	1.3	100	1.0
21	0.53	61	1.0	101	1.4
22	2.3	62	1.4	102	1.3
23	3.6	63	1.0	103	1.2
24	1.8	64	0.83	104	1.4
25	2.1	65	6.1	105	0.83
26	1.0	66	3.1	106	2.9
27	0.76	67	2.6†	107	2.5
28	0.90	68	2.6	108	2.0
29	0.83	69	1.4	109	0.83
30	1.0	70	1.3	110	1.0
31	1.2	71	0.48	111	0.58
32	1.3	72	1.4	112	1.1
33	2.0	73	4.2	113	0.70
34	1.0	74	1.2	114	0.76
35	0.58	75	3.1	115	1.1
36	1.6	76	4.5	116	1.4
37	0.58	77	2.1	117	1.5
38	0.53	78	2.0	118	2.0
39	0.43	79	4.5	119	0.43
40	0.53	80	2.7	120	0.48

\* Expressed as percent of most restrictive FCC limit of 0.2 mW/cm<sup>2</sup>, except as noted.

† Expressed as percent of applicable public limit for frequencies involved; Type EA-5091 probe used.

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Measured Power Density Levels  
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Location	Percent FCC Limit*	Location	Percent FCC Limit*	Location	Percent FCC Limit*
121	0.58	161	1.4	201	0.90
122	0.70	162	0.43	202	0.34
123	0.90	163	2.3	203	0.76
124	0.70	164	2.1	204	0.58
125	1.2	165	0.83	205	1.3
126	1.4	166	1.0	206	2.2
127	1.0	167	1.4	207	1.4
128	1.7	168	1.2	208	1.4
129	1.3	169	1.2		
130	1.8	170	1.9		
131	1.2	171	1.5		
132	0.58	172	2.7		
133	2.2	173	1.3		
134	5.6	174	1.7		
135	5.5†	175	1.7		
136	7.0†	176	0.90		
137	3.2	177	1.4		
138	3.4	178	2.8		
139	2.0	179	2.9		
140	2.6	180	4.8		
141	1.6	181	6.0†		
142	0.19	182	5.8		
143	1.0	183	4.5		
144	0.76	184	3.7		
145	0.53	185	0.90		
146	0.58	186	0.70		
147	0.53	187	1.3		
148	1.0	188	0.83		
149	1.2	189	0.53		
150	0.48	190	0.70		
151	1.0	191	0.48		
152	0.83	192	0.53		
153	1.0	193	0.38		
154	1.2	194	0.38		
155	0.53	195	0.34		
156	1.2	196	0.53		
157	1.3	197	0.43		
158	0.83	198	0.38		
159	1.0	199	0.48		
160	1.4	200	0.53		

\* Expressed as percent of most restrictive FCC limit of 0.2 mW/cm<sup>2</sup>, except as noted.

† Expressed as percent of applicable public limit for frequencies involved; Type EA-5091 probe used.