

County of San Mateo

Request for Modification to Approved 700 MHz Spectrum Allocation

September 24, 2010

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1. Introduction and Applicant Information - San Mateo County

Introduction:

Subject: County of San Mateo request for modification of 700 MHz Allocation

To whom it may concern

In February 2010, the County of San Mateo submitted a 700 MHz application for a P25 trunked radio system. The application was approved and FCC license was granted in July.

At this time the County is requesting modification to the original applications. Since submitting the original application, Motorola has completed the detailed design of the P25 system. The new design utilizes the same sites and overall coverage footprint of the initial application, but reduces spectrum requirements and potential interference to adjacent systems.

The changes to the original allocations that are being requested are primarily due to the reconfiguration of simulcast zones. The original design consisted of three simulcast cells (North County, South County and Coastal cell). The revised design consists of one 10 channel simulcast cell, and 8 ASR sites. This design change provides multiple benefits including;

- Requires fewer frequency pairs at high level sites
- Allows for reuse of more frequency pairs across the region
- Improves system reliability
- Reduces potential multipath in rugged coastal terrain
- More efficient fallback operations

We hope that the Regional Committee understand the need and benefits of this modification and accepts our request in the most expeditious manner in order for us to maintain our current system deployment schedule.

Applicant Information - County of San Mateo:

San Mateo County is one of 58 California counties and one of the nine San Francisco Bay Area counties. The County is the gateway tying San Francisco to the Silicon Valley. It is located on the San Francisco Peninsula, bordered by the Pacific Ocean to the West, the San Francisco Bay to the East, the City/County of San Francisco to the North, and the counties of Santa Clara and Santa Cruz to the South.

The County covers approximately 450 square miles with a population of 730,000. There are 20 incorporated cities and 17 unincorporated communities. San Mateo is an integral part of the greater San Francisco bay area as it is home to; a number Bio-Tech, financial and IT companies, two major freeways, San Francisco International Airport, two major bridges, the port of Redwood City and the primary water storage serving 3 million residents in the bay area.

San Mateo County currently operates San Mateo Trunked System (SMTS) which was deployed in 2002. This system utilizes 21 sites and provides radio communications throughout San Mateo County. It operates in the 490 MHz range (T-Band) and consists of two large simulcast zones (north/south county) and six fill in sites. This system currently supports approximately 1500 users of the departments/agencies listed below:

Agency	Subscribers
Coroner	20
DA	24
EMS	155

Agency	Subscribers
NTF	60
Parks	160
PHS	40
Probation	60
PSCC	28
Public Health	20
Public Works	152
ISD	42
Sheriff's Office	652
Allied Agencies	126
Total	1539

The users of the SMTS system provide Public Safety services to the following cities and communities:

San Mateo County Cities	San Mateo County Unincorporated Communities
Atherton	Broadmoor
Belmont	El Granada
Brisbane	Emerald Lake Hills
Burlingame	Highlands-Baywood Park
Colma	La Honda
Daly City	Loma Mar
East Palo Alto	Montara
Foster City	Moss Beach
Half Moon Bay	North Fair Oaks
Hillsborough	Pescadero
Menlo Park	Pigeon Point
Millbrae	Princeton
Pacifica	San Gregorio
Portola Valley	Sky Londa
Redwood City	West Menlo Park
San Bruno	
San Carlos	
San Mateo	
South San Francisco	
Woodside	

2. Funding Sources

September 24, 2010
Mr. George Lowry
Region 6 Planning Committee Chairman
State of California OES
3650 Shriever Avenue
McClellan, CA 95655

San Mateo County has been working with our public safety partners in the Bay Area to achieve greater regional interoperability. The County is committed to achieving the goals identified by of the Department of Homeland Security and supported by the State of California reflected in the SAFECOM Interoperability Continuum. To that end San Mateo County has embarked on a multi-phased project to migrate its Public Safety radio users to a 700 MHz P25 standards based network. The funding for this project will come from a combination of Federal Grants, County appropriations and long term financial instrument. Outlined below are the phases of project and the current funding status of those phases;

Phase	Funding	Funding Source	Completion
Develop P25 interface	\$2,000,000	Funded COP 2007 grant & County. Match	12/30/09
Functional Specification	\$ 475,000	Funded UASI 2007	8/15/09
Bayside 700Mhz Cell (101 corridor)	\$3,725,000	Funded UASI 07, PSIC 07 grants and match	6/01/11
Expanded Bayside coverage	1,267,000	Funded UASI 2008	12/30/10
Expand Bayside & Coastal	720,000	Funded UASI 2009	6/01/11
Coastal 700 MHz Cell	TBD	See note*	TBD
Subscriber Equipment	TBD	See note*	TBD

Note* The County of San Mateo released an RFP in September of 2009 to select a vendor to finalize a system design and implement the P25 network. Based on the vendor responses to this RFP, the County will evaluate and determine the preferred method for funding the remaining phases of the project. Funding options include, bonds, equipment lease, County appropriation and additional federal grants Included with this document below are copies of 3 MOU's between San Mateo County and the City of San Francisco related to the COPS 07, UASI 07 and PSIC grants to confirm the funding identified above. If you need additional information or clarification regarding project funding, please contact Steve Dupre, Radio Interoperability Manager, Information Services Department, County of San Mateo

**AGREEMENT BETWEEN THE CITY AND COUNTY OF
SAN FRANCISCO AND THE COUNTY OF SAN MATEO
FOR THE DISTRIBUTION OF FY 2007 COPS GRANT FUNDS**

THIS AGREEMENT is made this MAY 1, 2008, in the City and County of San Francisco, State of California, by and between THE COUNTY OF SAN MATEO ("San Mateo") and the CITY AND COUNTY OF SAN FRANCISCO, a municipal corporation ("San Francisco"). In its capacity as fiscal agent for the COPS Grant Working Group, as defined below, acting by and through San Francisco's Department of Emergency Management ("DEM").

RECITALS

WHEREAS, The United States Department of Justice ("DOJ"), through its Community Oriented Policing Services ("COPS") Grant Program, provides funds to local, state, and tribal law enforcement agencies to procure technology that focuses on the ability to share data information and enhance voice interoperability with regional, state, and federal partners, with the goal of increasing public safety. DOJ provides 75% of the costs of the grant and recipients must contribute 25% toward the award; and

WHEREAS, The City and County of San Francisco, through the Department of Emergency Management, applied jointly with the City of Oakland, and the Counties of Alameda, Contra Costa, and San Mateo (collectively with San Francisco, the "partner jurisdictions") for COPS Grant funding; and

WHEREAS, The partner jurisdictions received a total COPS grant award of \$7,845,314. The Department of Justice will provide \$5,733,986 of the grant funds, and the partner jurisdictions must provide \$1,911,328 in matching funds; and

WHEREAS, The partner jurisdictions have agreed to create a COPS Grant Working Group and to meet on a quarterly basis to provide progress reports on their projects; and

WHEREAS, San Francisco has been designated to serve as the Fiscal Agent for the COPS Grant, and to establish procedures and provide all financial services for distribution of COPS grant funds; and

WHEREAS, Pursuant to agreement by the partner jurisdictions to purchase equipment that will enhance interoperable communications and information sharing within the region, and benefit all partner jurisdictions, the COPS Grant Working Group has asked San Francisco to allocate funds to San Mateo on the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the premises and the mutual covenants contained in this Agreement and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the parties hereto agree as follows:

**AGREEMENT BETWEEN THE CITY AND COUNTY OF
SAN FRANCISCO AND THE COUNTY OF SAN MATEO
FOR THE DISTRIBUTION OF FY 2007 PUBLIC SAFETY INTEROPERABLE
COMMUNICATIONS GRANT FUNDS**

THIS AGREEMENT is made this **JUNE 9, 2008**, in the City and County of San Francisco, State of California, by and between the **COUNTY OF SAN MATEO** ("SAN MATEO") and the **CITY AND COUNTY OF SAN FRANCISCO**, a municipal corporation ("San Francisco" or "City"), in its capacity as fiscal agent for the UASI Approval Authority, as defined below, acting by and through San Francisco's Department of Emergency Management ("DEM").

RECITALS

WHEREAS, The United States Department of Homeland Security ("DHS") consolidated the separate San Jose, Oakland, and San Francisco Urban Areas into a combined Bay Area Urban Area ("BA UASI") for the purpose of application for and distribution of federal homeland security program grant funds; and

WHEREAS, The Bay Area UASI Region Approval Authority ("Approval Authority") was established as the Urban Area Working Group ("UAWG") for the BA UASI, to provide overall governance of the homeland security program across the BA UASI, to coordinate development and implementation of all federal homeland security grant program initiatives, and to ensure compliance with all grant program requirements; and

WHEREAS, The UASI General Manager is responsible for implementing and managing the policy and program decisions of the Approval Authority, directing the work of the UASI Management Team personnel, and performing other duties as determined and directed by the Approval Authority, and

WHEREAS, San Francisco has been designated as the grantee for federal homeland security grant funds granted to the BA UASI by the DHS through the California Governor's Office of Homeland Security ("OHS"), including Public Safety Interoperable Communications ("PSIC") grant funds, with responsibility to establish procedures and execute subgrant agreements for the distribution of grant funds to jurisdictions selected by the Approval Authority; and

WHEREAS, San Francisco has been designated to serve as the fiscal agent for the Approval Authority, and to establish procedures and provide all financial services for distribution of federal homeland security grant funds within the BA UASI; and

WHEREAS, Pursuant to grant distribution decisions by the Approval Authority, the UASI Management Team has asked San Francisco to distribute a portion of the PSIC grant funds to SAN MATEO on the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the premises and the mutual covenants contained in this Agreement and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the parties hereto agree as follows:

**AGREEMENT BETWEEN THE CITY AND COUNTY OF
SAN FRANCISCO AND THE COUNTY OF SAN MATEO
FOR THE DISTRIBUTION OF FY 2007 PUBLIC SAFETY INTEROPERABLE
COMMUNICATIONS GRANT FUNDS**

THIS AGREEMENT is made this **JUNE 9, 2008**, in the City and County of San Francisco, State of California, by and between the **COUNTY OF SAN MATEO** ("SAN MATEO") and the **CITY AND COUNTY OF SAN FRANCISCO**, a municipal corporation ("San Francisco" or "City"), in its capacity as fiscal agent for the UASI Approval Authority, as defined below, acting by and through San Francisco's Department of Emergency Management ("DEM").

RECITALS

WHEREAS, The United States Department of Homeland Security ("DHS") consolidated the separate San Jose, Oakland, and San Francisco Urban Areas into a combined Bay Area Urban Area ("BA UASI") for the purpose of application for and distribution of federal homeland security program grant funds; and

WHEREAS, The Bay Area UASI Region Approval Authority ("Approval Authority") was established as the Urban Area Working Group ("UAWG") for the BA UASI, to provide overall governance of the homeland security program across the BA UASI, to coordinate development and implementation of all federal homeland security grant program initiatives, and to ensure compliance with all grant program requirements; and

WHEREAS, The UASI General Manager is responsible for implementing and managing the policy and program decisions of the Approval Authority, directing the work of the UASI Management Team personnel, and performing other duties as determined and directed by the Approval Authority, and

WHEREAS, San Francisco has been designated as the grantee for federal homeland security grant funds granted to the BA UASI by the DHS through the California Governor's Office of Homeland Security ("OHS"), including Public Safety Interoperable Communications ("PSIC") grant funds, with responsibility to establish procedures and execute subgrant agreements for the distribution of grant funds to jurisdictions selected by the Approval Authority; and

WHEREAS, San Francisco has been designated to serve as the fiscal agent for the Approval Authority, and to establish procedures and provide all financial services for distribution of federal homeland security grant funds within the BA UASI; and

WHEREAS, Pursuant to grant distribution decisions by the Approval Authority, the UASI Management Team has asked San Francisco to distribute a portion of the PSIC grant funds to SAN MATEO on the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the premises and the mutual covenants contained in this Agreement and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the parties hereto agree as follows:

**AGREEMENT BETWEEN THE CITY AND COUNTY OF
SAN FRANCISCO AND THE COUNTY OF SAN MATEO
FOR THE DISTRIBUTION OF FY 2008 UASI REGIONAL FUNDS**

SECOND AMENDMENT

THIS AMENDMENT (this "Amendment") is made as of March 30, 2010, in San Francisco, California, by and between the COUNTY OF SAN MATEO ("SAN MATEO"), and the City and County of San Francisco, a municipal corporation ("City"), in its capacity as fiscal agent for the UASI Approval Authority, acting by and through the San Francisco Department of Emergency Management.

RECITALS

WHEREAS, City and SAN MATEO have entered into the Agreement (as defined below); and
WHEREAS, City and SAN MATEO desire to modify the Agreement on the terms and conditions set forth herein;

NOW, THEREFORE, SAN MATEO and the City agree as follows:

1. **Definitions.** The following definitions shall apply to this Amendment:
 - a. **Agreement.** The term "Agreement" shall mean the "Agreement between the City and County of San Francisco and the County of San Mateo for the Distribution of FY 2008 UASI Regional Funds" dated October 23, 2008 between SAN MATEO and City, as amended by the:
 - First Amendment, dated September 22, 2009
 - b. **Other Terms.** Terms used and not defined in this Amendment shall have the meanings assigned to such terms in the Agreement.
2. **Modifications to the Agreement.** The Agreement is hereby modified as follows:

a. **Section 3.1, Duration of Term.** Section 3.1 currently reads as follows:
The term of this Agreement shall commence on **OCTOBER 23, 2008** and shall end at 11:59 p.m. San Francisco time on **NOVEMBER 30, 2010.**

Such section is hereby amended in its entirety to read as follows:

The term of this Agreement shall commence on **OCTOBER 23, 2008** and shall end at 11:59 p.m. San Francisco time on **JANUARY 31, 2011.**

**AGREEMENT BETWEEN THE CITY AND COUNTY OF
SAN FRANCISCO AND THE COUNTY OF SAN MATEO
FOR THE DISTRIBUTION OF FY 2009 UASI REGIONAL FUNDS**

THIS AGREEMENT (“Agreement”) is made this October 1, 2009 in the City and County of San Francisco, State of California, by and between the COUNTY OF SAN MATEO (“SAN MATEO”) and the CITY AND COUNTY OF SAN FRANCISCO, a municipal corporation (“San Francisco” or “City”), in its capacity as fiscal agent for the UASI Approval Authority, as defined below, acting by and through San Francisco’s Department of Emergency Management (“DEM”).

RECITALS

WHEREAS, The United States Department of Homeland Security (“DHS”) consolidated the separate San Jose, Oakland, and San Francisco Urban Areas into a combined Bay Area Urban Area (“UASI Region”) for the purpose of application for and distribution of federal Urban Areas Security Initiative (“UASI”) Program grant funds; and

WHEREAS, The Bay Area UASI Region Approval Authority (“Approval Authority”) was established as the Urban Area Working Group (“UAWG”) for the UASI Region, to provide overall governance of the homeland security program across the UASI Region, to coordinate development and implementation of all UASI Program initiatives, and to ensure compliance with all UASI Program requirements; and

WHEREAS, The UASI General Manager is responsible for implementing and managing the policy and program decisions of the Approval Authority, directing the work of the UASI Management Team personnel, and performing other duties as determined and directed by the Approval Authority, and

WHEREAS, San Francisco has been designated as the grantee for UASI funds granted by the DHS through the California Emergency Management Agency (“CalEMA”) to the UASI Region, with responsibility to establish procedures and execute subgrant agreements for the distribution of UASI Program grant funds to jurisdictions selected by the Approval Authority to receive grant funding; and

WHEREAS, San Francisco has been designated to serve as the Fiscal Agent for the Approval Authority, and to establish procedures and provide all financial services for distribution of UASI Program grant funds within the UASI Region; and

WHEREAS, Pursuant to grant distribution decisions by the Approval Authority, the UASI Management Team has asked San Francisco to distribute a portion of the regional UASI grant funds to SAN MATEO on the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the premises and the mutual covenants contained in this Agreement and for the other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the parties hereto agree as follows:

3. Description of Planned 700 MHz Radio System

The San Mateo County has been working on a number of initiatives with regional partners in the Bay Area Urban Area Security Initiative (UASI) to improve Public Safety's First Responder's regional interoperability. The purpose of these efforts is to migrate to a Standards-Based system and leverage the newly available 700 MHz spectrum. San Mateo County's first priority is to migrate towards a P25 / 700 MHz system.

As part of these efforts, the County recently deployed a P25 Radio Switch with the necessary trunking control and switching hardware capable of integrating the existing UHF trunked system with any other P25 radio system regardless of frequency band or equipment manufacturer, to include the planned 700 MHz P-25 Phase 1 System.

The County entered into a contract in April, 2010 with Motorola Inc. for a new 700MHz P-25 Phase 1 system capable of migrating to P-25 Phase 2, comprised of 20 trunked repeater sites which incorporates simulcast technology in order to maximize spectrum efficiency.

The new system will be built with the intention of allowing other agencies to access it related to BayRICS. The County is also exploring the possibility of providing network access to SF and Santa Clara for routine activities. While the local cities are not migrating at this time, the system will be used on a limited basis by Cities for disaster communications and will be available to local agencies if and when they decide to migrate to 700 MHz. Those local agencies total loading is estimated at 3,000 users.

The service area for the County of San Mateo's planned 700 MHz radio system is defined in accordance with Region 6 procedures. The service area (Figure 1.) for the planned 700 MHz radio system is three miles beyond the geographical boundaries of the County of San Mateo.



Figure 1: County of San Mateo Radio System Service Area

4. Channel Loading Justification

Traffic:

San Mateo County requires the frequencies identified in this document based on the traffic analysis completed for this system. The traffic analysis included the required user inputs and system components in order to determine the Grade of Service (GOS). The user inputs include the number of talkgroups, the number of users, the distribution of users within the system, and the load model associated with each user group and the system components include the number of talkpaths in each RF cell.

Traffic Loading Analysis:

Definitions of the terms used in traffic analysis are provided below.

Definitions:

The following definitions are included to facilitate an understanding of Motorola's traffic loading analysis.

Erlang: A dimensionless unit of traffic intensity; 1 Erlang equals 1 call-hour per hour, or 3600 call-seconds per hour. Erlangs are a measure of the load offered to a system.

For example, during 1 hour, if 1800 seconds of a call activity is presented to a radio system, the traffic load is 0.5 Erlangs (1800 call-seconds per hour, divided by 3600 seconds per hour). Traffic load in Erlangs offered by a system is:

$$\text{Erlangs} = \frac{\text{Active Unit} \times \text{Unit Call Rate} \times (\text{Call Duration} + \text{Repeater Hang Time})}{3600}$$

Busy Hour

Within a 24 hour interval, the hour with the highest average traffic load, averaged over a statistically significant number of days. This is the "time consistent busy hour" per section 5.3 of ITU-T Recommendation E.600, Terms and Definitions of Traffic Engineering, March 1993.

There exists differing Busy Hour definitions, some using the worst case; e.g., the busiest hour of the busiest day of the busiest week (here this is referred to as the "Peak Hour"). Systems are not generally designed for "worst case" Busy Hour, because it requires expensive capacity over-design. Systems are generally designed to meet the loading requirements during the "time consistent Busy Hour" (here this is referred to as the "Average Busy Hour").

Grade of Service (GOS):

GOS – The percentage of calls in a system which cannot be completed immediately (i.e., calls that are blocked and receive a busy indication) during the system Busy Hour.

$$\text{Grade of Service} = \frac{\text{Number of Blocked Calls}}{\text{Total Number of Calls}}$$

Call Rate – Number of Calls per unit per hour. Sometimes specified as "PTTs per unit per hour", or similar wording. Call Rate here is for active users.

Call Duration - In trunked systems, the time between a voice channel grant and the end of a call.

Active Unit – A unique unit that generates call activity during the Busy Hour; Note that one unique unit can be several active units, since a user may change Talkgroups in the course of the Busy Hour.

Procedure:

The following section outlines the procedure used to model traffic for the proposed Trunked voice system.

Traffic Modeling Methods

Two methods can be used to model traffic within a system:

- ◆ Analytical modeling, using general mathematical formulas
- ◆ Simulation, using a computer program which models the behavior of a specific system

Analytical methods provide simple-to-use formulas; however, the applicability and limitations of these formulas must be understood to avoid misusing them. Simulation can be somewhat more complex, but is specifically applicable to the system to be modeled, and therefore provides the most accurate results (when given accurate inputs). Because of the architecture of the voice system, the Simulation method was used in order to obtain more accurate results.

Simulation Method

A “discrete event simulation” is a computer representation of the specific architecture and protocols used in the system to be modeled. After the appropriate inputs are provided and the simulation is started, the modeling is “event driven”; that is, calls are processed, queued, etc., just as they would be in the real system. A simulation clock is maintained, and simulation time passes as events occur; there can be multiple concurrent events at any instant of simulation time (for example, simultaneous multiple call requests). With each event, the status of the simulated system is updated; statistics are collected for performance analysis when the modeling is completed.

Note that any simulation is an abstraction of a system, so it can never be 100% accurate. The most accurate simulation results are obtained by using inputs which most accurately represent the system being modeled (talkgroup loading, site origination and involvement, quantity and type of channel resources per site, etc.). Also, since simulation results are based on statistical probabilities of events occurring, increasing the number of events (in this case, calls to be simulated) increases the confidence in the simulation results.

Motorola uses discrete event simulations of the proposed trunked system configuration for modeling the voice traffic performance.

Traffic Simulation Tool

Both coverage prediction and traffic analysis are performed in a single simulation tool. The modeling tool provides a Windows XP/2000 graphical environment to define systems, simulate coverage and traffic, and evaluate loading performance on the proposed trunked system configurations.

Given the expected voice traffic loading, the modeling tool can be used to predict the Grade of Service (GOS) for the system with a specified configuration of channel resources. The traffic simulation engine uses Erlang C as a basis for computations, therefore complying with the requirement that loading simulations be based on Erlang C. However the tool addresses the additional complexities of a wide area trunking system, including the fact that system loading is strongly correlated to the number of talkgroups in addition to the number of users.

Traffic Loading Information

Motorola based the user arrival rates, call duration, and subscriber counts on the information provided from the Counties current SmartZone system. Where loading information was unavailable Motorola used data from systems of similar size and complexity. This information provided actual call data information to project the number of required talkgroups, the user distribution among those talkgroups, the average length of calls, the arrival rate, and the number of active units. The user count used in the analysis includes both Public Safety and Public Service agencies. For purposes of the analysis, Motorola assumed that a like number of subscribers would be active during the busy hour for the 700MHz subsystems.

The analysis uses the number of talkpaths provided at the sites to project the probable GOS for each system wide and for each site. Talkgroup load information is identified in Table 4 below:

Table 4: Talkgroup Data

Talkgroup Name	Number of active units	Average arrival rate (Calls/unit/hour)	Average Message Length (sec)
County Wide			
San Mateo SO 1	10	13.6	5
San Mateo SO 2	10	13.6	5
San Mateo SO 3	10	13.6	5
Transit Police	4	12.5	5
Coroner 1	8	6.8	10
Coroner 2	8	6.8	10
EMS 1	12	6.8	16
EMS 2	12	6.8	16
EMS 3	12	6.8	16
EMS 4	13	6.8	16
Parks 1	11	20.4	5
Parks 2	11	20.4	5
Parks 3	11	20.4	5
OEM	3	6.7	5
Peninsula Home Society 1	10	5.1	10
Peninsula Home Society 2	10	5.1	10
Peninsula Home Society 3	10	5.1	10
Mutual Aid 1	19	2.0	10
Mutual Aid 2	19	2.0	10
Mutual Aid 3	19	2.0	10
Mutual Aid 4	19	2.0	10
Mutual Aid 5	19	2.0	10
Mutual Aid 6	20	2.0	10
Tactical Operations 1	19	1.0	10
Tactical Operations 2	19	1.0	10
Tactical Operations 3	19	1.0	10
Tactical Operations 4	19	1.0	10
Tactical Operations 5	19	1.0	10
Tactical Operations 6	20	1.0	10
Zone Zone Traffic 1	19	2.0	10
Zone Zone Traffic 2	19	2.0	10
Zone Zone Traffic 3	19	2.0	10
Zone Zone Traffic 4	19	2.0	10
Zone Zone Traffic 5	19	2.0	10
Zone Zone Traffic 6	20	2.0	5

Motorola modeled the traffic assuming the system was operating in message trunking mode. Message trunking allows for more efficient use of the system controller to assign channels in a trunking system, ensuring continuity of communication by minimizing the possibility a particular call or calls being reassigned a new channel in the system after each successive call or even getting a busy in the middle of a conversation. Message trunking operation allows for an assigned channel to remain active after a talkgroup call has ended, offering a period of time for additional users in that same talkgroup to begin another call without being reassigned a new channel.

Once each analysis run is completed a summary of results specifying individual cells or sites and system stats is presented, where adjustments in the channel count can be made in order to achieve the desired GOS. Infrastructure Load Model information

The system wide load model information consists of the number of cells contained in the ASTRO 25 system and the number of frequencies within each cell. The system parameters used are listed in Table 3

Site Name	Percent of Site Involvement	700MHz Voice Channels	TDMA Talkpaths
HOJ Simulcast Subsystem	90%	9 700MHz	18 Talkpaths
Towne Ridge ASR	20%	4 700MHz	8 Talkpaths
Brisbane Ice ASR	20%	4 700MHz	8 Talkpaths
Pescadero ASR	20%	4 700MHz	8 Talkpaths
Star Hill ASR	20%	4 700MHz	8 Talkpaths
Pomponio ASR	20%	4 700MHz	8 Talkpaths
Hostel Sam ASR	20%	4 700MHz	8 Talkpaths
Pigeon Point ASR	20%	4 700MHz	8 Talkpaths
La Honda Ridge ASR	20%	4 700MHz	8 Talkpaths

Table 3: Channel Count per Site Required to Deliver Required Grade of Service

Grade of Service Delivered

Public Safety target GOS is between 1.0 – 2.0%. Several simulations were performed with the given number of channels for each site with users uniformly distributed in the talkgroups to obtain a projected system wide GOS of 1.45%. Each subsystem GOS number varies dependent on the pseudo-random placement of users during the simulation run. The subsystem GOS numbers ranged from 0.88% to 2.47%.
Average Busy Queue

In addition to the GOS a system delivers, another important specification is the length of time in the busy queue. The busy queue is the amount of time a queued call has to wait before a voice channel is available to place a call. The predicted busy queue is shown in Figure 4 below. Figure 4 shows the cumulative percentage of busy calls that are queued over time including all users and talkgroups during the busy hour. The system is designed so that 90% of the calls in queue receive a call back within 4 seconds.

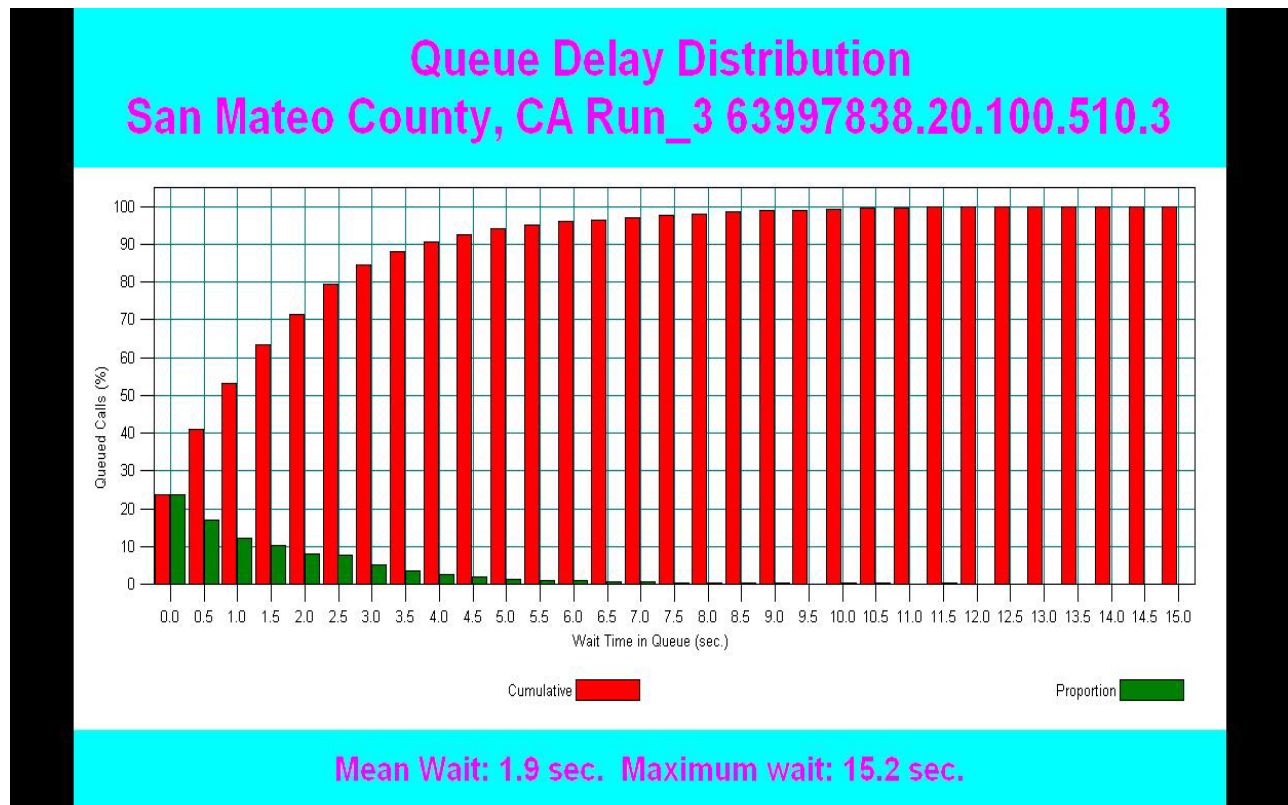


Figure 4: System-Wide Time in Queue

5. Request for 700 MHz Narrowband Voice Spectrum

The following 700 MHz channels are requested for the revised San Mateo County P25 Trunked System

Summarized Sites' Configuration and Location Data:

Site Name	Site Configuration	Latitude	Longitude
Foster City	Simulcast	37 34 10.66	-122 16 25.76
Hall Of Justice	Simulcast	37 29 17.67	-122 13 49.75
Mills Hospital	Simulcast	37 33 53.66	-122 19 34.76
San Bruno Nike	Simulcast	37 41 31.65	-122 26 53.78
San Carlos Site 60	Simulcast	37 29 23.67	-122 17 24.75
Sweeney Ridge	Simulcast	37 36 31.65	-122 27 26.78
Half Moon Bay PD	Simulcast	37 27 56.67	-122 25 54.77
North Peak	Simulcast	37 33 40.66	-122 28 39.78
Pise Lookout	Simulcast	37 27 19.67	-122 20 26.76
Rolph Hill	Simulcast	37 19 50.68	-122 12 49.74
Skylawn	Simulcast	37 30 13.67	-122 22 14.76
Huddart Park	Simulcast	37 26 19	-122 17 35
Brisbane Ice	ASR 1	37 41 31.65	-122 24 11.78
Pescadero	ASR 2	37 14 38.68	-122 24 0.75
Star Hill	ASR 3	37 21 58	-122 20 42.6
Pomponio	ASR 4	37 18 34.4	-122 22 45.4
Hostel Sam	ASR 5	37 32 3.66	-122 31 5.78
Pigeon Point	ASR 6	37 11 34.69	-122 22 5.75
Towne Ridge	ASR 7	37 17 16.68	-122 14 48.74
La Honda Verizon	ASR 8	37 19 21.42	-122 16 44.42

Simulcast System (12 Sites, 1 Zone -10 channels):

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
6	San Mateo	165-166	12.50 kHz	800.031250 MHz	770.031250 MHz
7	San Mateo	209-210	12.50 kHz	800.306250 MHz	770.306250 MHz
12	San Mateo	365-366	12.50 kHz	801.281250 MHz	771.281250 MHz
14	San Mateo	389-390	12.50 kHz	801.431250 MHz	771.431250 MHz
16	San Mateo	413-414	12.50 kHz	801.581250 MHz	771.581250 MHz
20	San Mateo	461-462	12.50 kHz	801.881250 MHz	771.881250 MHz
22	San Mateo	485-486	12.50 kHz	802.031250 MHz	772.031250 MHz
27	San Mateo	545-546	12.50 kHz	802.406250 MHz	772.406250 MHz
31	San Mateo	593-594	12.50 kHz	802.706250 MHz	772.706250 MHz
36	San Mateo	717-718	12.50 kHz	803.481250 MHz	773.481250 MHz

Eight (8) ASR Sites (channels reused to minimize overall channel requirements):**ASR - Brisbane Ice:**

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
10	San Mateo	329-330	12.50 kHz	801.056250 MHz	771.056250 MHz
19	San Mateo	449-450	12.50 kHz	801.806250 MHz	771.806250 MHz
24	San Mateo	509-510	12.50 kHz	802.181250 MHz	772.181250 MHz
34	San Mateo	629-630	12.50 kHz	802.931250 MHz	772.931250 MHz
37	San Mateo	781-782	12.50 kHz	803.881250 MHz	773.881250 MHz

ASR -Hostel Sam:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
10	San Mateo	329-330	12.50 kHz	801.056250 MHz	771.056250 MHz
19	San Mateo	449-450	12.50 kHz	801.806250 MHz	771.806250 MHz
30	San Mateo	581-582	12.50 kHz	802.631250 MHz	772.631250 MHz
34	San Mateo	629-630	12.50 kHz	802.931250 MHz	772.931250 MHz
37	San Mateo	781-782	12.50 kHz	803.881250 MHz	773.881250 MHz

ASR – Town Ridge:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
10	San Mateo	329-330	12.50 kHz	801.056250 MHz	771.056250 MHz
19	San Mateo	449-450	12.50 kHz	801.806250 MHz	771.806250 MHz
24	San Mateo	509-510	12.50 kHz	802.181250 MHz	772.181250 MHz
30	San Mateo	581-582	12.50 kHz	802.631250 MHz	772.631250 MHz
37	San Mateo	781-782	12.50 kHz	803.881250 MHz	773.881250 MHz

ASR – Star Hill:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
4	San Mateo	95-96	12.50 kHz	799.593750 MHz	769.593750 MHz
8	San Mateo	253-254	12.50 kHz	800.581250 MHz	770.581250 MHz
11	San Mateo	353-354	12.50 kHz	801.206250 MHz	771.206250 MHz
17	San Mateo	425-426	12.50 kHz	801.656250 MHz	771.656250 MHz
39	San Mateo	837-838	12.50 kHz	804.231250 MHz	774.321250 MHz

ASR – Pomponio:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
5	San Mateo	125-126	12.50 kHz	799.781250 MHz	769.781250 MHz
15	San Mateo	401-402	12.50 kHz	801.506250 MHz	771.506250 MHz
21	San Mateo	473-474	12.50 kHz	801.956250 MHz	771.956250 MHz
26	San Mateo	533-534	12.50 kHz	802.331250 MHz	772.331250 MHz
29	San Mateo	569-570	12.50 kHz	802.556250 MHz	772.556250 MHz

ASR – Pescadero:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
2	San Mateo	49-50	12.50 kHz	799.306250 MHz	769.306250 MHz
23	San Mateo	497-498	12.50 kHz	802.106250 MHz	772.106250 MHz
32	San Mateo	605-606	12.50 kHz	802.781250 MHz	772.781250 MHz
35	San Mateo	705-706	12.50 kHz	803.406250 MHz	773.406250 MHz
41	San Mateo	913-914	12.50 kHz	804.706250 MHz	774.706250 MHz

ASR – Pigeon Point:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
3	San Mateo	55-56	12.50 kHz	799.343750 MHz	769.343750 MHz
13	San Mateo	377-378	12.50 kHz	801.356250 MHz	771.356250 MHz
25	San Mateo	521-522	12.50 kHz	802.256250 MHz	772.256250 MHz
38	San Mateo	795-796	12.50 kHz	803.968750 MHz	773.968750 MHz
40	San Mateo	901-902	12.50 kHz	804.631250 MHz	774.631250 MHz

ASR - La Honda Verizon:

Channel	County	FCC Channel	Bandwidth	Mobile Frequency	Base Frequency
1	San Mateo	17-18	12.50 kHz	799.106250 MHz	769.106250 MHz
13	San Mateo	377-378	12.50 kHz	801.356250 MHz	771.356250 MHz
25	San Mateo	521-522	12.50 kHz	802.256250 MHz	772.256250 MHz
38	San Mateo	795-796	12.50 kHz	803.968750 MHz	773.968750 MHz
40	San Mateo	901-902	12.50 kHz	804.631250 MHz	774.631250 MHz

6. Radio Service Coverage and Interference Methodology

The included service coverage and interference maps for the County of San Mateo's proposed 700 MHz radio system, are based on the prediction methods as detailed in TIA/EIA TSB-88.1 - C.

The radio Contour maps include both FCC contour calculation and also propagation prediction methodology based on the Okumura/Hata/Davidson model with the Epstein-Peterson Diffraction implementation.

The FCC contours are based on the standard R-6602 curves with the accepted 9 dB adjustment to compensate for a 6 ft receiver antenna instead of the 30 ft receive antenna in R -6602. However, FCC Contour methodology is appropriate for simplistic allocation analysis and regulatory evaluation but does not provide an accurate representation of radio propagation and diffraction loss. Therefore, the Okumura/Hata/Davidson model with the Epstein-Peterson Diffraction implementation was used to produce the service and interference field strengths of the San Mateo radio system.

The propagation "extended" Okumura/Hata/Davidson model calculates the line-of-sight path between a transmitter and receiver based on the 1/3 arc-second, U.S. National Elevation Dataset (NED) and environmental classifications from the 1 arc-second USGS Land Use/Land Cover (LULC) dataset. In addition, the model incorporates path loss due to reflections and diffraction loss from terrain and environmental obstacles.

In addition to the above mentioned environmental variables, the radio signal's diffraction loss incorporates frequency band, antenna height, transmitter power, path distance, and receiver noise threshold. The propagation methodology used for the San Mateo County 700 MHz radio system coverage and interference maps is similar to the methodology adopted by APCO and accepted by the Federal Communications Commission (FCC) as detailed in TIA/TSB 88-C.

7. Appendix A: Overview of Modification Request

The following chart is a representation of the differences between the 700 MHz channels that have been approved and licensed for San Mateo County and what is now being requested to support the final 700 MHz system configuration under contract to Motorola.

Site Name	RPC Approved Channels	New Proposed	RPC Approved Assignment	New Proposed Zone Assignment
Brisbane Ice	49-50 209-210 365-366 437-438 485-486 545-546 593-594 913-914	329-330 449-450 509-510 629-630 781-782	Bayside North	ASR1
Cal Water Woodside	17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718	NA	Bayside South	NA
East Palo Alto	17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718	NA	Bayside South	NA
Foster City	17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	Bayside South	Simulcast

Half Moon Bay PD	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	Pacific	Simulcast
Hall of Justice	17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	Bayside South	Simulcast
Hostel Sam	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	329-330 449-450 581-582 629-630 781-782	Pacific	ASR 5
La Honda Verizon	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	17-18 377-378 521-522 795-796 901-902	Pacific	ASR8
Mills Hospital	17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	BaysideSouth	Simulcast

North Peak	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	Pacific	Simulcast
Pescadero	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	49-50 497-498 605-606 705-706 913-914	Pacific	ASR2
Pigeon Point	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	55-56 377-378 521-522 795-796 901-902	Pacific	ASR6
Pise Lookout	55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706	165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390	Pacific	Simulcast

<p>Rolph Hill</p>	<p>17-18 55-56 95-96 165-166 253-254 329-330 353-354 401-402 449-450 461-462 473-474 509-510 521-522 557-558 569-570 629-630 705-706 717-718</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390</p>	<p>Bayside South + Pacific</p>	<p>Simulcast</p>
<p>San Bruno Nike</p>	<p>49-50 209-210 365-366 437-438 485-486 545-546 593-594 913-914</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 837-838</p>	<p>Bayside North</p>	<p>Simulcast</p>
<p>San Carlos Site 60</p>	<p>17-18 95-96 165-166 253-254 353-354 401-402 461-462 521-522 557-558 717-718</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390</p>	<p>BaysideSouth</p>	<p>Simulcast</p>

<p style="text-align: center;">Skylawn</p>	<p>49-50 55-56 209-210 329-330 365-366 437-438 449-450 473-474 485-486 509-510 545-546 569-570 593-594 629-630 705-706 913-914</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390</p>	<p style="text-align: center;">Bayside North + Pacific</p>	<p style="text-align: center;">Simulcast</p>
<p style="text-align: center;">Stage Road Pomponio</p>	<p>55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706</p>	<p>125-126 401-402 473-474 533-534 569-570</p>	<p style="text-align: center;">Pacific</p>	<p style="text-align: center;">ASR4</p>
<p style="text-align: center;">Star Hill</p>	<p>55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706</p>	<p>95-96 253-254 353-354 837-838 425-426</p>	<p style="text-align: center;">Pacific</p>	<p style="text-align: center;">ASR3</p>
<p style="text-align: center;">Sweeney Ridge</p>	<p>49-50 209-210 365-366 437-438 485-486 545-546 593-594 913-914</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390</p>	<p style="text-align: center;">BaysideNorth</p>	<p style="text-align: center;">Simulcast</p>

<p>Towne Ridge</p>	<p>55-56 329-330 449-450 473-474 509-510 569-570 629-630 705-706</p>	<p>329-330 449-450 509-510 581-582 781-782</p>	<p>Pacific</p>	<p>ASR7</p>
<p>Huddart Park</p>	<p>NA</p>	<p>165-166 209-210 365-366 413-414 461-462 485-486 545-546 593-594 717-718 389-390</p>	<p>NA</p>	<p>Simulcast</p>

8. Appendix B: System Parameters and Service and Interference Coverage Maps

8.1 System Parameters

San Mateo
700 MHz Radio System
Technical Parameters

SiteName	TPO dBm	Transmit Antenna	Antenna Type	Antenna	Gain dBd	E Tilt Degrees	M Tilt Degrees	Azimuth Degrees	HPBW Degrees	ERP dBm
				AGL Feet						
Foster City	48.8	SE414-SF3PALDF	Dipole Array with Reflector	55	9	0	0	170	130	51.0
Hall Of Justice	49.3	SE414-SF3PALDF	Dipole Array with Reflector	150	10	0	0	170	90	51.6
Mills Hospital	47	SE414-SF3PALDF	Dipole Array with Reflector	75	9	0	0	170	130	49.1
San Bruno Nike	49	BCD-7509-EDIN-5-25	Omnidirectional	12	9	5	2	55	360	51.7
San Carlos Site 60	47.8	LPA-70063-4CF-EDIN-14	Panel	50	13	14	0	120	65	54.1
Sweeney Ridge	49.5	SE414-SF3PALDF	Dipole Array with Reflector	30	8	0	0	210	160	51.1
Half Moon Bay PD	50	BCD-7509-EDIN-5-25	Omnidirectional	47	9	5	0	0	360	52.3
North Peak	50	LPA-70063-4CF-EDIN-10	Panel	29	13	10	0	165	65	56.6
Pise Lookout	47.8	LPA-70063-4CF-EDIN-8	Panel	70	13	8	0	220	65	54.0
Rolph Hill	47.8	LPA-70063-4CF-EDIN-14	Panel	30	13	14	0	220	65	54.4
Skylawn	48.8	LPA-70063-4CF-EDIN-10	Panel	59	13	10	0	215	65	55.0
Huddart Park	49.5	LPA-70063-4CF-EDIN-4	Panel	14	13	4	0	150	65	56.1
Brisbane Ice	47.8	BCD-7509-EDIN-0-25	Omnidirectional	22	9	0	0	0	360	50.7
Pescadero	50	BCD-7509-EDIN-5-25	Omnidirectional	22	9	5	0	0	360	52.9
Star Hill	50	BCD-7509-EDIN-5-25	Omnidirectional	22	9	5	0	0	360	52.9
Pomponio	50	BCD-7509-EDIN-5-25	Omnidirectional	22	9	5	0	0	360	52.9
Hostel Sam	50	BCD-7509-EDIN-5-25	Omnidirectional	22	9	5	0	0	360	52.9
Pigeon Point	50	BCD-7509-EDIN-5-25	Omnidirectional	22	9	5	0	0	360	52.9
Towne Ridge	50	SE414-SF3PALDF	Panel	35	7.5	0	0	320	180	51.2
La Honda Verizon	50	BCD-7509-EDIN-5-25	Omnidirectional	12	9	5	0	0	360	53.0

The following twenty (20) System and Interference Maps provided on a separate PDF for ease of view

- 8.2 5dBu, 40dBu, 60bDu Contour Map – Foster City Site**
- 8.3 5dBu, 40dBu, 60bDu Contour Map – Hall of Justice Site**
- 8.4 5dBu, 40dBu, 60bDu Contour Map – Mills Hospital Site**
- 8.5 5dBu, 40dBu, 60bDu Contour Map – San Bruno Nike Site**
- 8.6 5dBu, 40dBu, 60bDu Contour Map – San Carlos Site 60**
- 8.7 5dBu, 40dBu, 60bDu Contour Map – Sweeney Ridge Site**
- 8.8 5dBu, 40dBu, 60bDu Contour Map – Half Moon Bay Site**
- 8.9 5dBu, 40dBu, 60bDu Contour Map – North Peak Site**
- 8.10 5dBu, 40dBu, 60bDu Contour Map – Pise Lookout Site**
- 8.11 5dBu, 40dBu, 60bDu Contour Map – Rolph Hill Site**
- 8.12 5dBu, 40dBu, 60bDu Contour Map – Skylawn Site**
- 8.13 5dBu, 40dBu, 60bDu Contour Map – Huddart Park Site**
- 8.14 5dBu, 40dBu, 60bDu Contour Map – Brisbane Ice Site**
- 8.15 5dBu, 40dBu, 60bDu Contour Map – Pescadero Site**
- 8.16 5dBu, 40dBu, 60bDu Contour Map – Star Hill Site**
- 8.17 5dBu, 40dBu, 60bDu Contour Map – Pomponio Site**
- 8.18 5dBu, 40dBu, 60bDu Contour Map – Hostel Sam Site**
- 8.19 5dBu, 40dBu, 60bDu Contour Map – Pigeon Point Site**
- 8.20 5dBu, 40dBu, 60bDu Contour Map – Towne Ridge Site**
- 8.21 5dBu, 40dBu, 60bDu Contour Map – La Honda Verizon Site**

9. Appendix C: FCC Form 601 Applications (5)

Applications submitted separately as PDF Files for ease of review.

10. Appendix D: Letters of Concurrence

Should the need for a LOC between San Mateo County and any potentially affected system owner, a mutually agreed upon agreement will be drafted for the purpose of working together to resolve the stated interference issue(s), and will submit a copy of each Letter of Concurrence to the appropriate Frequency Coordinator and FCC when appropriate for filing.