

County of Marin

Application for 700 MHz Frequencies

The County of Marin respectfully submits the following application for licensing 700 MHz frequencies in accordance with the Region 6 700 MHz plan.

County Information

Located north of San Francisco, Marin County is home to approximately 250,000 people within 28 cities, according to the 2008 estimates by the U.S. Census. Its proximity to San Francisco places Marin County within a major metropolitan center of the state of California. The topography of the county is very rugged and mountainous. These areas are typically heavily wooded and prone to fire hazard during the fire season.

MERA UHF T Band Radio System

The County of Marin through the Marin Emergency Radio Authority (MERA) presently operates a trunked radio system in the UHF T Band. A new computer-controlled digital radio system was constructed for county communications. The radio system is used by member agencies in the law enforcement, fire management, emergency medical, road maintenance, transit, public works, local government, and other county-based entities. The trunked radio system unifies public safety response, making it possible for members to more effectively and efficiently communicate with each other and within individual departments. The MERA voice radio communications network consists of the Motorola Digital SmartZone, UHF T-band trunked and simulcast communications network. It is designed to allow regional or wide area conversations between dispatch centers and mobile units operating throughout the county.

MERA is composed of twenty-six agencies with the common goal of providing uncompromised public safety communications. The MERA member agencies and their representatives are:

1. Alto-Richardson Bay Fire District
2. City of Belvedere
3. Bolinas Fire Protection District
4. Town of Corte Madera

5. Town of Fairfax
6. Inverness Public Utility District
7. Kentfield Fire Protection District
8. City of Larkspur
9. County of Marin
10. Marin County Transit District
11. Marin Community College District
12. Marin Municipal Water District
13. Marin Community Services District
14. City of Mill Valley
15. City of Novato
16. Novato Fire Protection District
17. Town of Ross
18. Ross Valley Fire Service
19. Town of Tiburon
20. Town of San Anselmo
21. City of San Rafael
22. City of Sausalito
23. Stinson Beach Fire Protection District
24. Tamalpais Fire Protection District
25. Tiburon Fire Protection District
26. Twin Cities Police Department

The MERA network is made up of five distinct "cells" to cover Marin County. These cells are:

- East Simulcast Cell: 101 Corridor, 9 channels and 6 transmit sites.
- West Simulcast Cell: West Marin area, 6 channels and 3 transmit sites
- Sonoma IR Cell: Northeast Marin County, 5 channels and 1 site.
- Bay Hill IR Cell: Northwest Marin County, 5 channels and 1 site.
- Bolinas IR Cell: West Marin and Bolinas Area, 5 channels and 1 site.

Presently the UHF T Band radio system operates above capacity and needs to be expanded to meet current and projected future needs. The radio system was designed to support 1,580 users with modest growth over a 20-year period. As of December 2009 there are an estimated 2,875 users on the MERA system and accordingly is currently overloaded with traffic by a factor of approximately 20%.

Efforts have been made to maximize the efficiency of the UHF T Band radio system and to search for additional channels. This particular band is heavily used in the San Francisco Bay Area and the few channels that have been

obtained for this purpose will improve the capacity but will not solve the long-term capacity issues that the County of Marin faces. Additional channels are now being added: one channel on the west zone, and two channels for the east zone. Presently there are users wanting to use the system and the County of Marin expects to increase the number of users to at least 4,000 if sufficient capacity can be obtained with the 700 MHz radio system.

In the "Final System Design Report" by AECOM dated April 29, 2010, County of Marin future radio system capacity needs are outlined as follows:

100% of existing radios	2,875 Radios
Additional 100 radios added each year for 15 years	1,500 Radios
Additional 20% for outside emergency responders	875 Radios
	—————
Total radio count for system design	5,250 Radios

700 MHz Proposed Radio System

The County of Marin proposes to operate a single simulcast system throughout the county. Experience with our present UHF T Band system is that county-wide channels are necessary for many of our member agencies and using multiple pairs of frequencies to achieve county-wide coverage is not spectrum efficient.

Accordingly, this application is based on the County of Marin's experience with both operations and coverage.

Existing County of Marin UHF T Band radio sites were used as the basis for the system design. The preliminary design showed lack of radio coverage in many areas so new radio sites were identified to provide fill-in coverage as required. The sites included in this request represent an attempt to provide adequate radio coverage to all of the populated areas of the County of Marin and all major roads.

Extensive use of computer modeling and directional antennas resulted in the proposal that meets all of the technical requirements of the Region 6 700 MHz Plan with a few exceptions.

Several radio sites are outside of the borders of the County of Marin and although directional antennas are proposed there will be some radio coverage beyond the limit in the Region 6 700 MHz plan.

The sites outside of the County of Marin are:

- Bayhills Road in Sonoma County
- Sonoma Mountain in Sonoma County
- Building 314 in San Francisco County

In addition, several proposed new sites are in the County of Marin but are near the north border of the county and have coverage that extends beyond the limit into Sonoma County.

These new proposed sites are:

- 101 Narrows
- Chileno
- Hammock Hill
- Tomales
- TRACON (Two Rock)

At these sites a directional antenna will not reduce the radio coverage outside of the County of Marin because coverage to the north of these sites is required. Some of these sites are using a directional antenna already to optimize useful coverage but the design can not completely eliminate coverage outside of the limits.

System Design and Channel Loading

A detailed analysis of present and projected future channel loading was performed for the County of Marin and the best long term solution was a system with 19 voice channels for the main simulcast system plus fill-in sites as necessary around the county.

In order to achieve this goal within the number of 700 MHz channels allotted to the County of Marin some form of 6.25 kHz equivalent voice paths will be necessary.

The technology for 6.25 kHz equivalent voice paths is still being developed and while P25 Phase II may be the solution at this time it is not proven.

The system design as proposed in this request is for P25 12.5 kHz channels that will adequately support today's channel loading but expansion in the future will require conversion to a 6.25 kHz equivalent voice path system.

For planning purposes the present known number of subscriber radios is rounded up to 3,000 units. This allows some immediate growth for the system.

For a system with 3,000 units, an average call duration of 5.9 seconds, and an average Push To Talk (PTT) of 1.3 per hour 12 voice paths are required to keep the delayed Grade of Service (GOS) to less than 1%.

Because of the terrain in the County of Marin fill-in sites are required. In most of the rural areas of the County of Marin the call volume is low so a full simulcast site is not justified. In order to operate with minimum interference at least three sets of frequencies are required for fill-in sites. Based on experience in the present MERA T Band system, four voice paths plus one control channel, a total of 5 radio channels, is required for the fill-in sites.

12 voice paths at one radio channel per voice path, plus one control channel for the simulcast system totals 13 radio channels.

13 radio channels for the simulcast system plus 15 radio channels for fill-in sites totals 28 radio channels.

The County of Marin respectfully requests that one additional 700 MHz channel be allotted to the County of Marin so that this system can be implemented.

Lacking the one additional channel requested the GOS degrades to 2.2%.

For future growth, a system upgrade to 6.25 kHz equivalent voice paths is required. With a 13 radio channel simulcast system there will be 24 voice paths (because one radio channel is dedicated to being the control channel) and at a full projected growth of 5,280 units the system will be essentially unblocking with a GOS of 0.0%.

At the same time the upgrade to 6.25 kHz equivalent voice paths the voice capacity of the fill-in sites will increase from four to eight voice channels.

Table 1 summarizes the design criteria for 28 700 MHz channels proposed to be used in the County of Marin and Table 2 summarizes the design criteria for a system with degraded capacity and only 27 radio channels.

Table 1

**County of Marin 700 MHz System
Total 28 Radio Channels**

	Number of Radio Channels	Voice Paths At 12.5 kHz 3,000 Users	GOS At 12.5 kHz 3,000 Users	Voice Paths At 6.25 kHz 5,280 Users	GOS At 6.25 kHz 5,280 Users
Simulcast Voice Path	12	12	0.8%	24	0.0%
Simulcast Control Channel	1				
Fill-In Site Voice Path	12 (4 per site)	12 (4 per site)		24 (8 per site)	
Fill-in Site Control Channel	3 (1 per site)				
Total	28	24		48	
Notes: Based on Queue Delay of 1.5 Seconds, Average call duration of 5.9 seconds, and Average PTT of 1.3 per hour.					

Table 2

**County of Marin 700 MHz System
Only 27 Radio Channels**

	Number of Radio Channels	Voice Paths At 12.5 kHz 3,000 Users	GOS At 12.5 kHz 3,000 Users	Voice Paths At 6.25 kHz 5,280 Users	GOS At 6.25 kHz 5,280 Users
Simulcast Voice Path	11	11	2.2%	22	0.1%
Simulcast Control Channel	1				
Fill-In Site Voice Path	12 (4 per site)	12 (4 per site)		24 (8 per site)	
Fill-in Site Control Channel	3 (1 per site)				
Total	27	23		46	
Notes: Based on Queue Delay of 1.5 Seconds, Average call duration of 5.9 seconds, and Average PTT of 1.3 per hour.					

Table 3
County of Marin 700 MHz System
Proposed Channels

	Marin Use	FCC Channel	Bandwidth	Mobile Transmit Frequency	Base Transmit Frequency
1	S1	127-128	12.50 kHz	799.79375 MHz	769.79375 MHz
2	IA1	137-138	12.50 kHz	799.85625 MHz	769.85625 MHz
3	S2	167-168	12.50 kHz	800.04375 MHz	770.04375 MHz
4	IB1	243-244	12.50 kHz	800.51875 MHz	770.51875 MHz
5	S3	255-256	12.50 kHz	800.59375 MHz	770.59375 MHz
6	IC1	287-288	12.50 kHz	800.79375 MHz	770.79375 MHz
7	S4	331-332	12.50 kHz	801.06875 MHz	771.06875 MHz
8	IA2	355-356	12.50 kHz	801.21875 MHz	771.21875 MHz
9	S5	367-368	12.50 kHz	801.29375 MHz	771.29375 MHz
10	IB2	391-392	12.50 kHz	801.44375 MHz	771.44375 MHz
11	S6	415-416	12.50 kHz	801.59375 MHz	771.59375 MHz
12	IC2	439-440	12.50 kHz	801.74375 MHz	771.74375 MHz
13	S7	463-464	12.50 kHz	801.89375 MHz	771.89375 MHz
14	IA3	487-488	12.50 kHz	802.04375 MHz	772.04375 MHz
15	S8	511-512	12.50 kHz	802.19375 MHz	772.19375 MHz
16	IB3	535-536	12.50 kHz	802.34375 MHz	772.34375 MHz
17	S9	559-560	12.50 kHz	802.49375 MHz	772.49375 MHz
18	IC3	583-584	12.50 kHz	802.64375 MHz	772.64375 MHz
19	S10	607-608	12.50 kHz	802.79375 MHz	772.79375 MHz
20	IA4	631-632	12.50 kHz	802.94375 MHz	772.94375 MHz
21	S11	675-676	12.50 kHz	803.21875 MHz	773.21875 MHz
22	IB4	719-720	12.50 kHz	803.49375 MHz	773.49375 MHz
23	S12	783-784	12.50 kHz	803.89375 MHz	773.89375 MHz
24	IC4	827-828	12.50 kHz	804.16875 MHz	774.16875 MHz
25	S13	871-872	12.50 kHz	804.44375 MHz	774.44375 MHz
26	IA5	915-916	12.50 kHz	804.71875 MHz	774.71875 MHz
27	IB5	947-948	12.50 kHz	804.91875 MHz	774.91875 MHz
28	IC5	TBD	12.50 kHz	TBD	TBD

Notes:

- Marin Use "S" to be used at Simulcast Sites
- Marin Use "IA" to be used at Fill-in Sites Group A
- Marin Use "IB" to be used at Fill-in Sites Group B
- Marin Use "IC" to be used at Fill-in Sites Group C

Additional Information in Appendixes

A list of proposed radio sites is in Appendix A including proposed antenna type and orientation.

Appendix B has individual FCC 50,50 R-6602 contour maps for 40 dBuV (service area) and 60 dBuV (adjacent channel interference) for each site.

Appendix C has individual FCC 50,50 R-6602 contour maps for 5 dBuV (co-channel interference) for each site.

Appendix D has FCC Form 601 applications for the system.

Appendix E has proof of funding documentation.