CITY OF OAKLAND

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AGENDA REPORT

TO: DEANNA J. SANTANA
CITY ADMINISTRATOR

FROM: AHSAN BAIG
INTERIM DIRECTOR

SUBJECT: SUPPLEMENTAL PUBLIC SAFETY TECHNOLOGY NEEDS

DATE: June 20, 2013

City Administrator Approval Deanna Santana Date 6/20/13

COUNCIL DISTRICT: City-Wide

REASON FOR SUPPLEMENTAL OR REPLACEMENT

The City Administrator has issued several informational memorandums regarding the City's Public Safety Radio system. This supplemental provides all of the informational memorandums released as additional reference to the Public Safety Technology Needs report.

For questions regarding this report, please contact Ahsan Baig, Interim Director of Information Technology, at (510) 238-3010.

Respectfully submitted,

/s/
AHSAN BAIG
Interim Director
Department of Information Technology

ATTACHMENTS:
Attachment A – P25 Public Safety Radio System-Status Report, March 29, 2013
Attachment B – P25 Public Safety Radio System-Status Report, August 9, 2012
Attachment C – P25 Public Safety Radio System, August 2, 2012
Attachment D – Evaluation of P25 Public Safety Radio System Performance, July 17, 2012
Attachment E – P25 Radio System Implementation Update, January 30, 2012
Attachment F – P25 Radio System Implementation Update, December 12, 2011
Attachment G – Update P25 Radio System Implementation, August 26, 2011

Item: _____
[redacted]
June 25, 2013

ATTACHMENT A

DISTRIBUTION DATE: 3/29/13

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Jim Reese

SUBJECT: P25 PUBLIC SAFETY RADIO SYSTEM—STATUS REPORT

DATE: March 29, 2013

City Administrator Approval /s/ Deanna J. Santana

Date 3/29/13

INFORMATION

The purpose of this memorandum is to provide an update about current efforts made to identify and resolve recurring, intermittent issues with the City's P25 radio system. Since our last update, City staff and our vendor partners have continued their efforts to investigate and resolve numerous instances of radio frequency (RF) interference, and other operational issues which affected the performance of our first responder radios. This effort, in conjunction with the ongoing technical review into individual radio trouble reports made by our first responders have led City staff to take immediate corrective actions to resolve and stabilize the P25 radio system.

In addition to these efforts, in August 2012, the City began negotiations with the East Bay Regional Communications Authority (EBRCSA) to fully understand the costs involved to utilize the EBRCSA P25 radio system as an alternative to maintaining and operating the City's P25 radio system. This was one of several alternatives presented by the City's consultant RCC to resolve infrastructure and operational deficiencies found during the course of the consultant's investigation. Staff has been examining the technical feasibility of migrating our public safety communications to the EBRCSA radio system as well as conducting a cost-benefit analysis between both respective options.

Given the City's immediate need to provide reliable radio communications to our first responders, and since the EBRCSA P25 radio system had not yet been fully constructed, and did not provide radio coverage in the Oakland area, City staff began concentrating its efforts and limited resources to improve reliable radio communications to the City's P25 radio system as a short-term solution, while continuing to investigate various long-term solutions, including EBRCSA.

In August 2012, City staff concluded that numerous instances of officers reporting trouble with their radio were correlated to radio frequency (RF) interference occurring near cellular sites in various areas around the City. Immediately following this discovery, the City began to address RF interference testing and mitigation with Pericle Communications. We have engaged in field testing and verification of RF interference sources, filing applicable FCC reports to notify cellular operators to mitigate sites which have verified interference, and conducted technical RF

lab testing of our public safety radio fleet to verify the equipment meets all applicable standards in order to qualify for interference protection under FCC rules. These lab tests and field verificafion and mitigations are documented in the attached report named, "Subscriber Radio Performance Measurements." The summary of this report is as follows:

- Testing confirins that our P25 radio fieet exceeds all applicable performance standards and is therefore entitled to interference protection under FCC rules
- Field tesfing has verified that RF interference is caused directly or indirectly by signals coming from wireless transmission sites operated by cellular providers, either individually or in a combination of signals from the cellular carriers.
- FCC rules require wireless operators to mitigate interference upon notification and verification. The Oakland team has been working collaboratively with cellular carriers to mitigate interference on a case-by-case basis.

As of January 21, 2013, 43 wireless sites have been tested with the following results:

- 13 AT&T sites showed no problems
- 5 Nextel sites mitigated by the carrier
- 2 AT&T sites are complicated by another nearby public safety licensee, no resolution
- 1 co-located site was jointly mitigated by AT&T and Sprint-Nextel
- 3 sites are unable to be mitigated due to other signal level issues
- 20 AT&T sites mitigated by the carrier (19 reduced power, 1 beam up-tilt)

The testing report outlines the types of RF interference being experienced by our public safety radios, root causes, and recommended mitigation strategies to the responsible wireless carriers. The issue of cellular RF interference to public safety radios is not a new issue, and Oakland is among many other public safety licensees, both locally and nationwide who experience cellular RF interference. The City team continues to work diligently to locate and resolve cases of RF interference to ensure our first responders' radios perform within public safety standards.

While the issue of RF interference has been certainly a large contributor to the trouble experienced by our first responders, it is not the sole cause. The City discovered deficiencies in relation to the maintenance of our radios which have contributed to radio communication performance issues. City staff has taken numerous steps to address these deficiencies and continues to remedy them on an ongoing basis.

Since the RF interference mitigations began, and in conjunction with improvements to the maintenance of the subscriber unit fieet, and additional operational procedures, overall trouble reports have dropped by well over 85%, and the P25 radio system availability is performing above 99.999% which is well within public safety standards. In addition to the reduction in trouble reports, staff conducted a survey in January 2013 of the Oakland Police Department Communications Center dispatch staff in order to directly measure the perception and subjective opinions of improvements made since August 2012; about 50% of the active dispatch staff responded to the non-scientific survey. The key result of this survey is as follows:

In comparison to August 2012, is the P25 performing better, worse, or about the same?

- Much Better 34.6%
- Somewhat Better 30.8%
- Slightly Better 19.2%
- About the Same 15.4%
- Slightly Worse 0.0%
- Somewhat Worse 0.0%
- Much Worse 0.0%

We continue to direct public safety staff to report any radio problems so that we may continue to remedy these issues. City staff is making ongoing small, targeted improvements to the P25 radio system that produce positive, quantitiable results while continuing to investigate and resolve each and every radio trouble report. Over the next few weeks, staff anticipates completing the last phase in our maintenance plan which is anticipated to produce improvements in overall subscriber radio performance.

The technical review into EBRCSA is ongoing; however, it is important to note that the current phase of this investigation is focused on the ability for the City to migrate its existing radio subscriber fleet onto the EBRCSA P25 system. While much attention has been put on the ability of P25 radios to be "vendor agnostic" to allow interoperability across jurisdictions, regardless of radio manufacturer, the reality is interoperability should not be confused with operability. In fact, in the event Oakland were to migrate the subscriber radios onto EBRCSA as a full-time subscriber, it would be the very tirst public safety users to attempt to intermix a subscriber unit fleet with a different manufacturer's respective P25 radio system on a full-time basis, which causes the City to review this alternative with great caution. This is certainly not without great technical risk, and Oakland is well served in researching and testing all operational aspects of how our existing subscriber unit fleet is going to operate and react on the EBRCSA P25 system in regular day-to-day use.

To accomplish this testing, once City staff was notified by EBRCSA that it had completed construction of the radio sites covering Oakland, we provided two of our portable subscriber radio units to have them programmed onto the EBRCSA P25 system and allow for testing of both coverage, and subscriber operations. The City then contracted with RCC to complete the in-building coverage portion of the testing and signed an agreement with EBRCSA to allow the testing to commence. EBRCSA provided our programmed subscriber units back to the City in mid-February; since that time we have been working with our consultant to refine the test plan and tinalize the automated test collection process. Staff anticipates having RCC begin their portion of the testing in mid-April, with tinal results on the testing provided to the City in early July.

This testing is the first step toward the City making a decision on how it wishes to proceed. It is important to note that the Oakland P25 radio system is a shared regional communications system, very much the same way EBRCSA serves multiple public entities. In addition to serving the day-to-day communication needs of the Oakland Police and Fire Departments, the Oakland

P25 radio system also serves several external entities, including the City of Piedmont (Police & Fire), Oakland Housing Authority (Police), Oakland Unified School District, Oakland School Police, and the Port of Oakland. Oakland serves these external entifies in the form of service contracts and MOU's, and would need to consider and involve these entities in any decision to migrate users to another radio system.

The concept of Oakland operating and maintaining its own P25 radio system goes back to the regional vision for public safety interoperability under the current UASI project called BayRICS, or Bay Area Regional Interoperable Communications Systems. The Oakland P25 system is part of this regional "system of systems" approach for comecting all first responders in the Bay Area, and the Oakland P25 radio system was the first radio system to begin this interconnection to other systems when it demonstrated the first interoperable link to the underground BART P25 radio system in 2012.

Systems like Oakland are meant to be the gateway for smaller enfities, like EBRCSA, whose mission is to consolidate many smaller radio systems across counties into a single system and allow their users to connect into the region using larger hub systems, like Oakland. In terms of interoperability from a technical perspective, the Oakland P25 radio system and its users are already fully equipped to communicate with neighboring jurisdictions for purposes of mutual-aid. Oakland has allowed numerous users to communicate on our P25 radio system, including the California Highway Patrol, East Bay Regional Park District, BART, and many other public safety entities.

Over the next month, additional progress will be made in several areas:

- Confinue to investigate and mitigate cases of RF interference.
- Complete the maintenance on all Oakland Police portable subscriber units.
- Commence the in-building tesfing of the EBRCSA P25 radio system.
- Present a detailed plan to fully address the findings and recommendations of the RCC Consultants' independent radio system performance evaluation report.

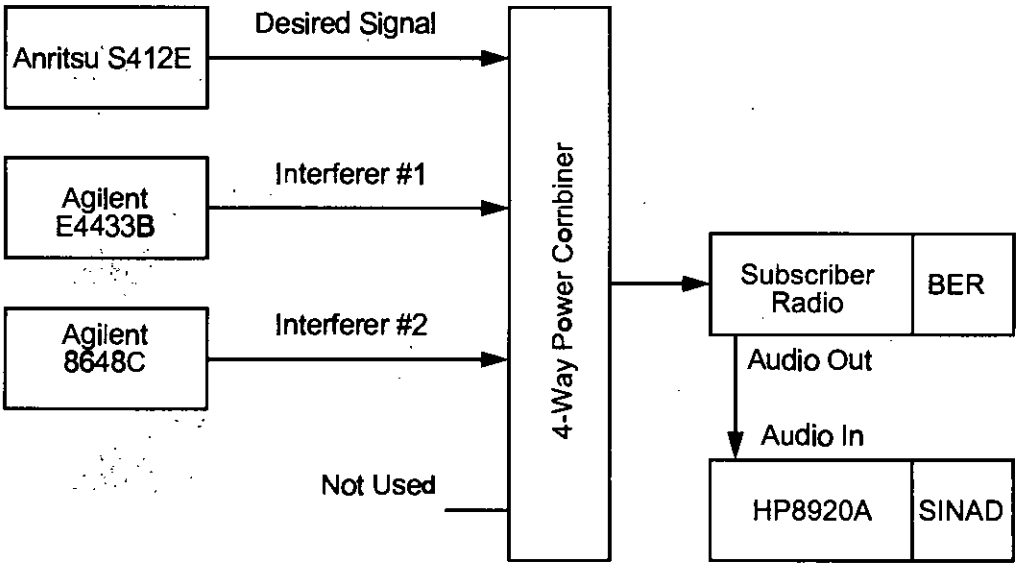
Updates regarding progress made on resolving additional radio system issues will be forthcoming on a regular basis.

Respectfiilly submitted,

/s/
JIM REESE
Interim Administrative Services Director

Attachment (1)

Subscriber Radio Performance Measurements



March 19, 2013
(Final Report)

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Subscriber Radio Performance Measurements

1.0 Executive Summary

The City of Oakland ("Oakland") operates a 10-channel 800 MHz P25 simulcast trunked radio system in the 851-861/806-816 MHz public safety radio band. This radio system has been rebanded and is operating on its post-rebanded frequencies. Oakland recently experienced degradation of mobile and portable radio performance at numerous locations in the Oakland metropolitan area. Investigation by the City, its vendor Harris Corporation and its consultant Pericle Communications Company shows that the interference is caused directly or indirectly by signals emanating from cell sites operated by AT&T Mobility and Sprint-Nextel. In several cases, a combination of signals from Sprint-Nextel and AT&T Mobility is the culprit. In other cases, just one operator's cell site is required to cause harmful interference.

The nationwide 800 MHz rebanding project, funded by Sprint-Nextel, is designed to significantly reduce the occurrence of interference to public safety radio systems by separating the public safety band from the commercial wireless band. The potential for interference remains after rebanding, but at a much reduced level.

Interference from 800 MHz cell sites generally falls into three categories: transmitter out-of-band emissions (OOBE), receiver intermodulation (IM) and receiver overload. OOBE from AT&T cell sites in Oakland have been measured by the parties and found in virtually all cases to be too weak on the street to cause harmful interference. Receiver IM, on the other hand, is a problem and has been documented at numerous cell sites in Oakland. Receiver overload tends to occur at interfering levels above where receiver IM first appears, but overload can be the dominant problem very close to the cell site when a single carrier is present.

The wireless operators are obligated to mitigate interference under Part 22.970 of the FCC rules, even if the interference is created inside the public safety radio receiver as receiver IM [1]. With the cooperation of AT&T Mobility and Sprint-Nextel, the Oakland team (Oakland, Harris, Pericle) has been mitigating this interference on a case-by-case basis through a variety of means, including reducing transmitter power at the interfering cell sites.

Because receiver IM and overload are the dominant problems in Oakland, it is important to verify that the Oakland subscriber radios are meeting the applicable minimum performance standards, as found in FCC Part 22.970 [1]. Radios that do not meet minimum performance standards are not entitled to full protection under FCC rules. Accordingly, the parties requested that Pericle perform bench tests of the radios for the purpose of verifying that the radios meet minimum performance standards for sensitivity, adjacent channel rejection and receiver intermodulation per Part 22.970.

Oakland public safety users primarily use Harris P7200 portable radios and M7200 mobile radios. P7100 portable radios are also used and one new XG-75 portable radio was measured to compare it to older 7200 and 7100 model radios.

1.1 Compliance with FCC Minimum Performance Standards. Measurements were collected in accordance with TIA-603-D, an industry standard for analog FM radio operation [2]. Although the Oakland radios operate on a P25 digital trunked radio system, Part 22.970 was written with analog radios in mind, so TIA-603-D is the appropriate standard for these tests. Generally, digital receiver interference susceptibility is strongly correlated with analog susceptibility because the interference typically occurs in the receiver front end where hardware is common to both modes. The Part 22.970 receiver minimum standards are shown in Table 1.

Table 1 - Part 22.970 Minimum Performance Standards			
Type	12 dB SINAD Sensitivity, dBm	Adj. Channel Rejection, dB	Intermod Rejection, dB
Mobile	-116	75	75
Portable	-116	70	70

Part 22.970 receiver compliance measurements of Oakland radios are shown in Table 2.

Table 2 - Measurement Summary (Part 22.970 Compliance Per TIA-603-D Test Methods)				
Model	S/N	12 SINAD Sensitivity, dBm	Adj. Channel Rejection, dB	Intermod Rejection, dB
P7200	A40041008E0B	-124.2	75.0	78.4
P7200	A4004100CB04	-123.6	75.2	75.7
P7200	A4004100C7A2	-123.8	74.2	74.4
P7200	A4004100CF64	-122.9	74.4	74.7
M7200	A4007400277C	-125.9	75.0	80.1
M7200	A40074002532	-125.9	75.7	81.1
P7100	9153197	-122.0	70.6	77.6
P7100	9153211	-122.4	71.5	78.1
P7100	9152390	-123.0	71.9	77.4
P7100	9153229	-122.4	70.9	77.4
XG-75	A40204000C2D	-123.4	72.2	78.4

Comparing the measurements of Table 2 with the minimum standards of Table 1, we see that all tested radios pass all three minimum standards.[1] Thus, the radios are entitled to protection under Part 22.970 provided the minimum desired signal level at the interference location is above threshold (-104 dBm for mobiles, -101 dBm for portables).

1.2 Background on the Problem in the Field. Given that OOBE are for the most part negligible and the subscriber radios comply with FCC Part 22.970 standards, one might ask why is there still a problem? The answer is that even the best quality commercially available radios have limited ability to tolerate strong interfering signals. Testing in the Oakland metropolitan area supports this conclusion. Consider the following:

- Signals from Sprint-Nextel and AT&T Mobility cell sites, either alone or in combination, are strong enough and occur on the correct frequencies to create harmful receiver intermodulation. These cases are well documented and the information has

[1]The values in Table 2 are the average of 10 values collected over the 10 receive frequencies used in the Oakland system. Both upper and lower adjacent and IM channels were measured and the lowest value of rejection is listed in Table 2. It is important to note that none of the measurements on any frequency fell below the minimum standard, including lower adjacent and upper adjacent channels.

been shared with the parties. Measured levels on the street near cell sites are routinely greater than -20 dBm and are sometimes greater than -10 dBm. Receiver intermodulation interference (3rd order) begins to affect the receiver at roughly -45 dBm.

- Signals from Sprint-Nextel and AT&T Mobility cell sites are in many cases strong enough to cause receiver overload without receiver intermodulation. Overload occurs at roughly -17 dBm of total interfering power. Although stronger signals are required to cause overload than receiver intermodulation, overload is still common because it does not require the precise mathematical relationship inherent to receiver IM. GSM signals in the 869-870 MHz band are especially troublesome because the front-end filter in the Oakland radios does not attenuate signals at these frequencies.

1.3 AT&T vs. Sprint-Nextel. The City of Oakland operates its radio system on frequencies between 851 and 855 MHz. Sprint-Nextel operates its iDEN push-to-talk radio network between 854 and 869 MHz, but following rebanding it will operate exclusively between 862 and 869 MHz. AT&T Mobility operates in two subbands, 869-880 MHz and 890-891.5 MHz. The 800 MHz band plan in Oakland is shown in Figure 1.

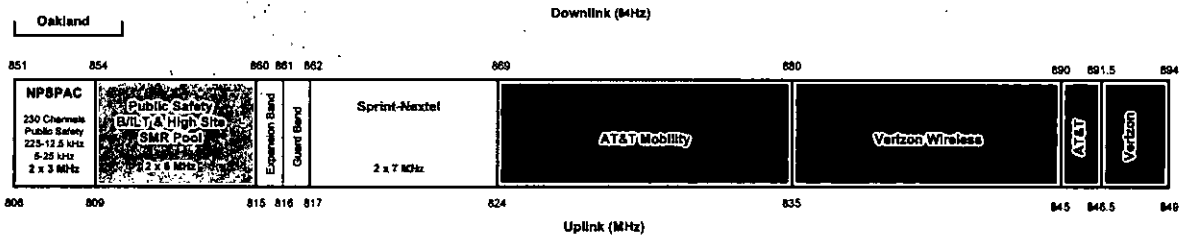


Figure 1 - 800 MHz Band Plan in Oakland, CA

To date, the main source of harmful interference has been AT&T Mobility despite the fact that Sprint-Nextel occupies spectrum adjacent to Oakland. There are several reasons for this disparity. First, Sprint-Nextel operates fewer active cell sites and handles many fewer calls than AT&T. When problems occur in Oakland, Sprint-Nextel usually just turns off the offending signal. The company can afford to do so because it is migrating customers off its iDEN network and will deactivate the network completely by 2017 with some markets terminating soon as June 2013. In its place, Sprint-Nextel will activate new CDMA base stations in the 862-869 MHz band at most of the existing iDEN cell sites. As the CDMA sites are activated, the potential for harmful interference will increase, but the lower power density (Watts/Hz) of CDMA compared to iDEN and somewhat taller sites than AT&T (on average) are mitigating factors.

AT&T, on the other hand, operates a densely populated network that handles a very high call volume each day. Many sites have antennas relatively close to the ground, resulting in strong signals that can cause receiver overload and receiver intermodulation by themselves or receiver intermodulation in combination with Sprint-Nextel signals.

1.4 Recommendations. There is a parallel effort in Oakland to mitigate interference on a site-by-site basis. To date, 47 sites have been investigated and most have been mitigated. See the Appendix to this report for a summary of this effort. Subscriber radio measurements have been used to better understand the interference experienced in the field and to guide mitigation efforts. Because bandpass filters are one of the best mitigation techniques, Pericle has acquired and has been testing 10 external filters with mobile radios. These filters provide over 30 dB rejection at 869 MHz. If bandpass filters prove effective in testing, Oakland should consider installing them in all vehicles with mobile radios.

Unfortunately, there is no practical bandpass filter solution available for the portable radios.

A complete analysis of mitigation methods is beyond the scope of this report, but following are some actions that deserve consideration as part of a larger effort to achieve a long term solution: employ cell site antennas with less null fill, reduce cell site transmitter power (already being done), use bandpass filters for mobiles (testing now), try small bandpass filters molded into the portable antenna (requires hardware development), and replace the P7200 with a newer radio like the XG-75. None of these solutions comes free of charge and some are only partial fixes. Cost-benefit tradeoffs may be necessary to arrive at an optimal solution.

2.0 Test Plan

800 MHz interference generally falls into three categories:

- *Out-of band emissions* (OOBE) which are unlikely from AT&T Mobility due to filtering used at the cell site. One exception is passive intermodulation (PIM) interference in the transmit antenna, but AT&T and Sprint-Nextel test for PIM at site activation and PIM tends to cause interference to the wireless operator's receivers, too. Thus, PIM is likely to be detected through normal cellular network operations.

- *Receiver intermodulation* which is possible, especially 3rd order products that include GSM signals in the 890-891.5 MHz band and 3rd order products that are mixes between AT&T and Sprint-Nextel carriers.

- *Receiver overload* which is caused by strong signals that do not have the mathematical relationship to produce IM products by themselves in the public safety radio receiver, but are strong enough to compress the front-end amplifier and desensitize the receiver. Receiver overload has three types: blocking, local oscillator (LO) mixing and receiver desense. These three types are defined by the Safecom best practices guide [3].

It is important to note that the first type of interference is most easily corrected by filtering at the cell site (unless there is PIM) while the other two types are most easily corrected by filtering at the subscriber radio. A typical public safety radio front-end filter passes 845-875 MHz, but quality is uneven and there is no industry standard for these filters.

Another type of interference that does not fall into any of these three categories is image

frequency interference. This type of interference occurs when a strong signal on the receiver's image frequency gets past the front-end filter and mixes with the LO in the first mixer to fall directly on the intermediate frequency (IF).[2]

All of these types of interference were investigated during this project.

The test plan generally followed the procedures described in TIA-603-D. A block diagram of the test setup for sensitivity, adjacent channel rejection and IM rejection is shown in Figure 2.

It is important to note that many signal generators have phase noise that is too high to measure adjacent channel or IM rejection down to the 70 dB level. Through trial and error, Pericle determined that its Agilent E4433B signal generator had sufficiently low phase noise and for this reason it was used for the adjacent channel interferer and the first IM interferer. Cable and splitter losses were measured with an Agilent E5071B network analyzer and the final calculations for each measurement were adjusted to account for these losses. All test equipment had current calibration at the time of testing. Test equipment used are listed in Table 3.

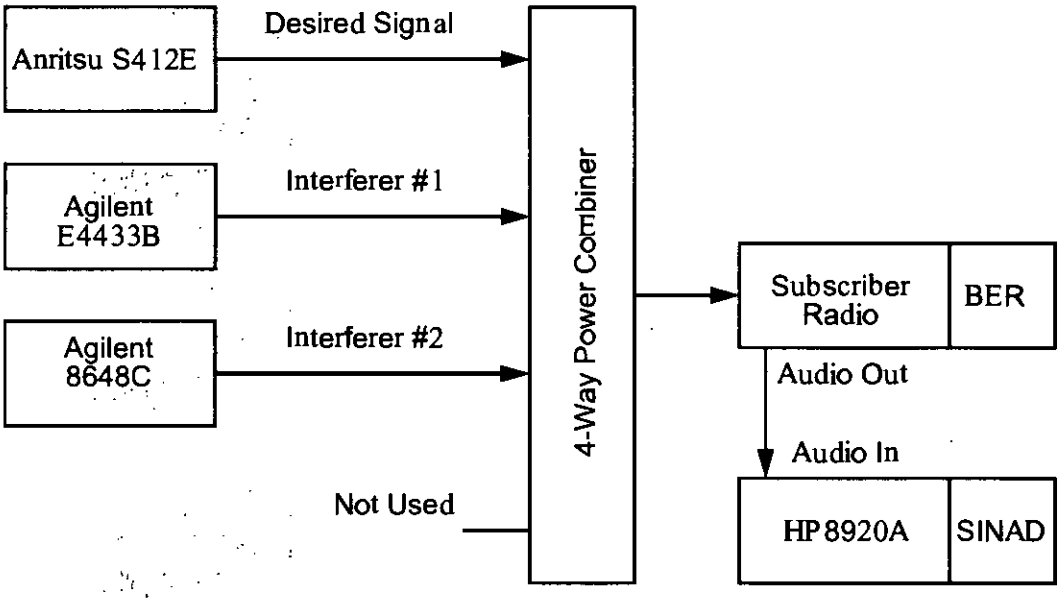


Figure 2 - Test System Block Diagram

The S412E LMR Master was loaned to Pericle by Anritsu. It was used to generate both analog and digital desired signals for the subscriber radio. In the digital case, the S412E was set to generate the standard P25 C4FM test signal which is a continuously repeating sequence of the bits 1011. This signal is similar to, but not identical to the Harris Corporation WCQPSK signal used on its simulcast networks. The S412E is not capable of generating a WCQPSK signal.

[2]The image frequency is twice the IF frequency above or below the RF frequency depending on whether the LO configuration is high side or low side, respectively.

Table 3 - Test Equipment Used				
Mfr.	Model	Type	S/N	Cal Due
Anritsu	S412E	LMR Master	1108054	Current
Agilent	E4433B	Signal Generator	US40051614	Dec 2014
Agilent	8648C	Signal Generator	3426A00754	Dec 2014
Agilent	8920A	Service Monitor	3350A07553	Dec 2014
Agilent	E5071B	RF Network Analyzer	MY42403489	Feb 2013

For receiver sensitivity measurements, both analog and digital, the two interfering signal generators were turned off. For adjacent channel rejection measurements, the 8648C signal generator was turned off.

Signal levels for image rejection and receiver overload are necessarily quite high and at these levels, phase noise in the 8648C dominates, even at frequencies above 869 MHz with desired frequencies below 855 MHz. For this reason, a bandpass filter was used with the 8648C for these measurements.

Because the broadband UMTS signals and even the 200 kHz-wide GSM signals used by AT&T Mobility do not resemble the standard interfering signals of TIA-603-D, some spot checks were done with GSM and UMTS interferers using the E4433B. IM measurements using these signals show that the subscriber radios respond to interference power in the receiver IF bandwidth in the same way regardless of the type of interferer. Similarly, for overload measurements, the total power in the RF passband is what matters, regardless of the type of signal.

3.0 Test Results

Part 22.970 measurements of receiver sensitivity, adjacent channel rejection and IM rejection were collected in accordance with TIA-603-D. Note that TIA-603-D requires that the adjacent channel be spaced 25 kHz away and be generated with two audio modulating tones, one at 650 Hz and one at 2200 Hz, each with 2.5 kHz deviation. The interferers for IM rejection are spaced at 50 kHz and 100 kHz from the carrier with the first signal unmodulated and the second modulated with a 400 Hz tone at 3 kHz deviation. Part 22.970 measurements are summarized in Table 4 (also found in Table 2 of the Executive Summary).

Adjacent channel rejection above about 75 dB is most likely limited by phase noise in the signal generator, so actual performance may be better than indicated in Table 4.

Note that all radios exceed the FCC Part 22.970 minimum performance standards listed in Table 1 (see Executive Summary).

Table 4 - Measurement Summary (Part 22.970 Compliance Per TIA-603-D Test Methods)				
Model	S/N	12 SINAD Sensitivity, dBm	Adj. Channel Rejection, dB	Intermod Rejection, dB
P7200	A40041008E0B	-124.2	75.0	78.4
P7200	A4004100CB04	-123.6	75.2	75.7
P7200	A4004100C7A2	-123.8	74.2	74.4
P7200	A4004100CF64	-122.9	74.4	74.7
M7200	A4007400277C	-125.9	75.0	80.1
M7200	A40074002532	-125.9	75.7	81.1
P7100	9153197	-122.0	70.6	77.6
P7100	9153211	-122.4	71.5	78.1
P7100	9152390	-123.0	71.9	77.4
P7100	9153229	-122.4	70.9	77.4
XG-75	A40204000C2D	-123.4	72.2	78.4

4.0 Conclusions

The P7200, M7200, P7100 and XG-75 subscriber radios all pass the minimum performance standards specified in FCC Part 22.970 and therefore qualify for interference protection provided the desired signal exceeds the minimum threshold of -104 dBm for mobiles and -101 dBm for portables [1].

Perhaps the most important defense against cellular 800 MHz interference is a good bandpass filter in the front end of the subscriber receiver. Virtually all contemporary receivers must pass frequencies up to 869 MHz because they must be compatible with pre-rebanded and post-rebanded systems. Thus, the bandpass filter cannot help with interference from Sprint-Nextel sites which generally operate in the 862-869 MHz band. Filter rejection in the cellular band is possible, but no practical filter is a brick wall and some energy from cellular operator signals will get into the receiver.

Following are some corrective actions that deserve consideration: employ cell site antennas with less null fill, uptilt antennas, reduce cell site transmitter power (already being done), use bandpass filters for mobiles (testing now), try small bandpass filters molded into the portable antenna (requires hardware development), and replace the P7200 with a newer radio like the XG-75.

Bandpass filters for the mobile radios and a replacement portable radio (like the XG-75) are the most straightforward solutions, but like all effective solutions, there is significant cost involved. Long term, manufacturers should install filters in public safety radios that only pass the post-rebanded public safety band (851-861 MHz). Such a filter should attenuate both Sprint-Nextel signals and AT&T signals sufficiently to eliminate the interference problem for all practical purposes.

5.0 References

[1] 47 CFR, Part 22.970, "Unacceptable interference to part 90 non-cellular 800 MHz licensees from part cellular radiotelephone or part 90-800 MHz cellular services, October 1, 2012.

[2] TIA-603-D, "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards," June 24, 2010.

[3] A Best Practices Guide, "Avoiding Interference Between Public Safety Wireless Communications Systems And Commercial Wireless Communications Systems At 800 MHz," December, 2000, www.safecomprogram.gov.

[4] TIA TSB-88.1-C, TSB-88.2-C, TSB-88.3-C, "Wireless Communications Systems Performance in Noise and Interference-Limited Situations, Recommended Methods for Technology-Independent Modeling, Simulation and Verification," February, 2008.

Appendix - AT&T Site Mitigation Summary

As of January 21, 2013, the following summary applies to the Oakland interference mitigation effort:

43 locations visited:

- 13 AT&T sites showed no problem (preemptive visits, no prior complaints)
- 5 sites Nextel mitigated
- 2 sites complicated by public safety site repeater interference, no resolution yet
- 1 site Nextel and AT&T both mitigated (included in 20 AT&T mitigated sites below)
- 3 sites signal too low or excessive multipath (cannot be attributed to cellular operator)
- 20 sites AT&T mitigated (1 beamtilt, 19 reduced power)

See the attached spreadsheet for more information.

	Latitude	Longitude	Address	City	Oakland P25 Signal Level	Bit Error Rate	UMTS Modification	GSM Modification	Test Date and Time	Signals at Site	Zip
1	37.7846338	-122.240916	2011 EAST 12TH STREET	Oakland	-80 dBm	8%	-3 dB Lower	-5 dB and 5 deg. Oowntilt from 13 deg.	21 Sep 1900	LTE 2 UMTS GSM mid, PCS 1940-55 2 UMTS & GSM and no 1955	94606
2	37.47326	-122.15305	601 5th Ave	Oakland	-77 dBm	12%	Need to involve BART who has not rebanded	Need to involve BART who has not rebanded	1700 26Sep in street and next to building alpha	LTE 2 UMTS GSM mid, PCS 1940-55 2 UMTS & GSM and 1955 VZW	94606
3	37.78725	-122.19476	4300 MACARTHUR BLVD	Oakland	-85	15%	-4 dB both and Beta/Gamma	-10 dB	0907 26Sep Corner of High4and MacArther	LTE 2 UMTS GSM low, PCS 1940-55 2 UMTS & GSM (no 1985)	
4	37.8523333	-122.223666	1307 TUNNEL ROAD	Oakland		0%	None	None	1600 70ct12	LTE 2 UMTS GSM low, PCS 1940-55 Couldn't get close to site	
5	37.4739	-122.14347	1930 12th Ave	Oakland		0%	None	None	1500 26Sep	ATT and Nektel but high and blocked building roof site	
6	37.7389722	-122.175583	10203 E STREET	Oakland		0%	None	None		ATT Only	
7	37.81204	-122.1987	2810 Mountain Blvd Same as Hwy 13 and Miller	Oakland	-85	14%	-6dB single upper	None	24-Sep	Adding UMTS carrier	
8			400 Alcatraz Ave	Oakland	-85	1%	none	None	1437 7oct12	2 UMTS GSM low on north, PCS ATT only	
9			1189 58th Ave	Oakland		0%	none	None		Cell Site but Not ATT - found no interference - In industrial complex	
10	37.454	-122.10308	8925 Holly Street	Oakland		0%	none		0800 26Sep	RECHECK	
11	37.77457	-122.23077	3100 East 9th Street	Oakland	-80	>10%	-4 dB	-10 dB	915 25Sep Beta in front of Bank of America BETA	LTE, 850 UMTS X2. GSM low, PCS 1940-SS 2 UMTS & GSM (no 1985)	
12	37.48142	-122.16148	1587 Franklin Street	Oakland		0%	none			Att and Nextel in area	
13	37.48404	-122.15532	2150 Webster Street Site likely on hotel on harrison	Oakland		0%	none		1000 26Sep	High Site, unlikely problem	
14	37.8394722	-122.263416	5427 TELEGRAPH	Oakland	-73	9%			1400 7Oct12	2UMTS LTE GSM high ATT only PCS also	
15	37.7603888	-122.221	4909 TIDEWATER AVE	Oakland	-75	7%	-5 dB both	-10 dB	1015 25Sep Capital Intermodal hard to make happen	LTE 2 UMTS GSM high, PCS 1940-55 2 UMTS & GSM (no 1985)	
16	37.7922222	-122.258527	601 8TH STREET Does Not Exist	Oakland		0%	none	None	1530 26Sep	Most Ukely Nextel	
17	37.7587222	-122.186694	7425 E 14TH STREET	Oakland		0%	none	None	0830 26Sep	RECHECK!	

	Latitude	Longitude	Address	City	Oakland P25 Signal Level	Bit Error Rate	UMTS Modification	GSM Modification	Test Date and Time	Signals at Site	Zip
18	37.8253055	-122.267	3601 TELEGRAPH AVE	Oakland	-75	12%	-4 dB Both	-8 dB	1600 26Sep on 37th at bend gamma	LTE 2 UMTS GSM high, PCS 1940-55 2 UMTS & GSM (no 1985)	94609
19	37.77185	-122.20048	Bancroft Ave @ Fairfax Blvd 5407 Bancroft	Oakland	-84	8%	GSM Mitigated	UMTS Mitigated	1300 8Oct12	ATT Nextel	95601
20	37.73599	-122.16416	International Blvd @ Durant Blvd	Oakland	-79	15%	None (Nextel Interference Problem, Nextel Channel Off)	None (Nextel Interference Problem, Nextel Channel Off)	25-Sep In rear parking lot at base of tower	NEX,ATT and VZW LTE, 850 UMTS X2. GSM exp, PCS 1940-55 2 UMTS & GSM (yes UMTS 1985)	
21	37.73048	-122.21073	Oakland Airport Hangar 3 8711 Earhart Road (ATT Site 8)	Oakland	-73	12%	-5 dB Upper	-10 dB	1045 25Sep Intersection Swan and	No LTE 1 UMTS GSM low, PCS 1940-55 2 UMTS & GSM (no 1985)	
22	37.8290277	-122.290861	1552 BEACH STREET	EMERYVILLE	-85	10%	ATT -6 UMTS	-4 GSM	1400 21Sep12	ATT and VZW, LTE UMTS, GSM	94608
23	37.8796388	-122.306916	1255 EASTSHORE HWY	BERKELEY							
24	37.7040555	-122.161055	1465 FACTOR AVE	San Leandro	-90	15%	None Multipath Simulcast Overlap	None Multipath Simulcast Overlap	1502 25Sep by 1401 address Beta	LTE 2 UMTS GSM high, PCS 1940-55 2 UMTS & GSM (no 198	
25	37.6968888	-122.183277	13800 MONARCH BAY DR	San Leandro	-93	11%	4 degree downtilt	4 degree downtilt	1127 25 Sep Fairway and Blue Whale Beta	LTE 2 UMTS GSM high and low and exp, PCS 1940-55 2 UMTS & GSM (no 1985)	
26	37.6886944	-122.13397	50 EAST LEWELLING	San Leandro	-95	12%	None Desired Signal too Low	None Desired Signal too Low	25 September 2012 in parking lot at site Alpha	ATT, Nextel and VZW	
27	37.48339	-122.2272	Naval Air Station	Treasure Island							
20	37.75776	-122.145	3769 Dorisa Ave	Oakland	-85	0%	None	None	5 Oct 12 No interference		
29	37.70581	-122.12979	1459 150th Ave	San Leandro	-93	CC Scan	-4 both UMTS carriers	-10 (GSM Low)	25 Sep 1623 Parking lot HofBrua	ATT and VZW LTE, 850 UMTS X2. GSM low, PCS 1940-55 2 UMTS & GSM (yes UMTS 1985)	
30	ATT		80 Grand Ave	Oakland	-65	0%	None	None	1629 26Sep	LTE 2 UMTS GSM high, PCS 1940-55 2 UMTS & GSM	
31	NEXTEL		4600 Telegraph	Oakland	-20	0%	None	None	1230 70ct12	Nextel only 868 range	
32	NEXTEL 37.85793	-122.24381	Domingo and Ashbey 11 Domingo Ave.	Oakland	-85	3%	Nextel moved 854 MHz to 863 MHz Channel		1500 70ct12	Nextel and VZW 854 MHz Active and 861s	

	Latitude	Longitude	Address	City	Oakland P25 Signal Level	Bit Error Rate	UMTS Modification	GSM Modification	Test Date and Time	Signals at Site	Zip
33	Nextel	-122.274	7th St. and Broadway	Oakland	-75	3%	Nextel moved 854 MHz to 863 MHz Channel		1600	Nextel with 854 MHz active	
	37.79975								7-Oct-12		
34	Nextel	-122.22888	30th Ave and 14th St.	Oakland	-80	3%	Nextel moved 854 MHz to 863 MHz Channel		2300	Nextel with 854 MHz active	
	37.77911								11-Oct-12		
35	ATT	-122.25276	Adams and MacArthur	Oakland	-75	18%	ATT Beta UMTS -3 dB	ATT GSM -3 dB Alpha	0900 16Nov12	ATT Only	94611
	37.8162										
36	37.79841	-122.28356	2nd St and Brush	Oakland	-70	8%		Nextel – 3dB 7 carriers	1100 16Nov12	ATT, Nextel, VZW	94607
37	37.799922	-122.270925	9th St and Webster	Oakland	-70	6%	ATT – 2 dB on UMTS		1500 16NoV12	ATT Only	94507
38	37.78449	-122.22219	2112 Fruitvale	Oakland	-90	11%	ATT UMTS – none	GSM -4 dB two sectors	1200 16Jan13	ATT	
										VZW	
										Sprint	
39	37.797	-122.20452	3022 MacArthur	Oakland	-85	12%	ATT UMTS -1 dS both carriers	ATT GSM -10 dB	1300 16Jan13	ATT	
							Nextel -3 dB all carriers			Nextel	
										T-Mobile	
										Sprint	
40	37.78111	-122.17603	Overdale and Seminary Rd	Oakland	-95 and lower	8%	None	None	1400 16Jan13	ATT	
							Desired Signal too Low	Desired Signal too Low		VZW	
										TMobile	
41	37.71693	-122.18268	Redwood and Mountain Blvd	Oakland	-95	10%	None Multipath Suspected	None Multipath Suspected	1500 16Jan13	ATT	
										Sprint	
										TMobile	
42	37.811824	-122.266609	2255 Broadway	Oakland		0%			1200		
									21-Jan-13		
43	37.802886	-122.239256	2825 Park Blvd	Oakland	-75	13%			1300 21Jan13		
44	37.808583	-122.253678	401 Grand Ave	Oakland	-85	20%			1400 21Jan13		
45	37.827105	-122.278826	36th St and San Pablo	Oakland	-85	0%			1500 2 Uan13		
					Cc scan rpt						
46	37.831347	-122.245437	5000 Piedmont Ave								
47	37.746929	-122.200894	8000 Coliseum Way								

ATTACHMENT B

DISTRIBUTION DATE: 8/9/12

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: David Cruise

SUBJECT: P25 PUBLIC SAFETY RADIO SYSTEM—STATUS REPORT

DATE: August 9, 2012

City Administrator Approval /s/ Deanna J. Santana

Date 8/9/12

INFORMATION

The purpose of this memorandum is to provide an update about recent efforts made to identify and resolve recurring, intermittent issues with the City's P25 radio system. Since our last update on August 2, City staff and our vendor partners initiated an in-depth technical investigation of each of the radio system failures reported by Oakland police officers. This effort has involved data collection from a thorough review of the P25 system logs, design documents, hours of on-the-air recording tapes, and all documented trouble reports filed by the communications center, as well as speaking to users who have reported troubles. While this process is ongoing, this memo presents the current findings of this investigation.

City staff has concluded that numerous instances of officers reporting trouble with their radio were correlated to radio frequency (RF) interference received by the P25 radio system. We have conducted an extensive RF investigation that included collecting data from around the city at all times of day.

On August 7, City staff officially notified the Public Safety & Homeland Security Bureau of the Federal Communications Commission (FCC) with its findings, and an enforcement investigation has begun. Due to the sensitive nature of this investigation, no further information is available at this time.

City staff is reviewing all of the submitted design documents for our P25 system and are conducting a detailed single point of failure analysis to ensure all potential causes for failure which may exist are immediately addressed.

In conjunction with this design review, City staff, including members of the Oakland Police Department, Oakland Fire Department, and Office of Emergency Services, are reviewing their existing standard operating procedures to ensure reliable communications are maintained in the event of a future communications disruption caused by equipment failure, radio interference, or natural disaster.

As part of the examination by the City of Oakland of the regional EBRCSA radio system, City staff has taken the next step to request and schedule technical-level meetings to review the EBRCSA system specifications in order to analyze and determine if the EBRCSA system could support our first responders. This technical review includes a detailed review of the system design, concept of operations, and operational impacts to our dispatchers as a result of the transition. City staff expects this review and assessment to be completed within 45-60 days.

Over the next week, focus will be in the following areas:

- Continue to fix problems as the sources of the problems are identified.
- Complete the installation of a back-up power generator at a second radio site.
- Review coverage maps to develop additional solutions to enhance radio coverage.
- Present a detailed plan to fully address the findings and recommendations of the RCC Consultants' independent radio system performance evaluation report.
- Continue to brief the City Administrator on a regular basis until all problems are identified and resolved.

Updates regarding progress made on resolving radio system issues will be forthcoming on a regular basis until the problems are resolved.

Frequently Asked Questions

Over the past few weeks, a number of questions have been raised about the radio system; the following responses clarify areas of misunderstanding and correct some inaccuracies.

Question:
Why did the City of Oakland Adopt the P25 System?

Answer:
The City of Oakland purchased a complete P25 upgrade to replace its older, out of date, analog radio system. This was done as a cost-effective solution for Oakland to meet the federal interoperability requirements of our region and ensure first responders had the ability to communicate with all neighboring jurisdictions. Oakland was the first city in the Bay Area to transition to a digital radio system that met the P25 interoperability specification as dictated by the Department of Homeland Security and the Bay Area Urban Area Strategic Initiative (UASI).

Question:
How much did the City spend on the new P25 radio communications system?

Answer:
Unlike other entities in the Bay Area, no local city funds have been used for this project, nor has the City incurred any debt obligation. The funding for this system was provided in the form of $7.5M in grant funding, and $10.5M in "rebanding" funding provided to the City of Oakland as part of our spectrum relocation from Sprint/Nextel.

Question:
Why doesn't the City of Oakland join the regional EBRCSA system now?

Answer:
The EBRCSA system is not fully constructed, and it is not 100% operational. The site that would cover the majority of the City of Oakland is still under construction. The EBRCSA staff has indicated that this site will not be operational or ready for its first users until late October.

At this time, there are very few users on the EBRCSA system, and no single department anywhere near as large as the Oakland Police Department has yet transitioned to their system. We are committed to ensuring reliable communications for our first responders today without delay. We are analyzing all options to achieve this, including closely examining what the operational impacts will be for us to achieve a successful transition of our dispatch communications centers as part of our full assessment of the EBRCSA option.

Respectfully submitted,

/s/
DAVID CRUISE
Public Safety Systems Advisor
Office of the City Administrator

ATTACHMENT C

DISTRIBUTION DATE: 8/2/12

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Ken Gordon

SUBJECT: P25 PUBLIC SAFETY RADIO SYSTEM

DATE: August 2, 2012

City Administrator Approval /s/ Deanna J. Santana

Date 8/2/12

INFORMATION

The purpose of this memorandum is to provide an update about recent efforts made to identify and resolve recurring, intermittent issues with the City's P25 radio system. The Department of Information Technology (DIT) and its vendor partners—Daily Wells Communications Inc. and Harris Corporation—fully acknowledge that the City's public safety staff have experienced many frustrations with the P25 technology; we are working quickly and applying every available resource to close this critical performance gap and bring the communications system to a fully functional standard that meets the needs of our first responders. The team has initiated a thorough process to identify and validate every complaint and concern raised by our first responders to ensure that every reported problem has been addressed to their satisfaction.

Appointment of a P25 Public Safety Systems Advisor

As a starting point towards ensuring system performance, the City Administrator has appointed David Cruise as the P25 Public Safety Systems Advisor accountable to the City Administrator. His key responsibilities will be to provide focused oversight to examine the findings and recommendations presented in the independent radio system evaluation report and advise the Administrator's Office on alternatives available to the City. Mr. Cruise will also work with the Department of Information Technology to develop a comprehensive program for managing radio operations to meet the mission-critical needs of our first responders.

Mr. Cruise brings 12 years of radio communications and broadband/wireless technology experience to the City, which will allow him to have an immediate impact on the City's efforts to improve the performance of the radio system.

Mr. Cruise served as the Communication Systems Project Manager for the Golden Gate Bridge, Highway & Transportation District. In this capacity, he managed the design and deployment of the first multi-county trunked P25 radio communications system in California utilizing 700 MHz public safety spectrum. This was a $22.5 million project for the three operating divisions of the Bridge District and its public safety partners.

His other related work experience includes:

- Serving SBC – Pacific Bell, FiberTower, and the Golden Gate Bridge, Highway & Transportation District
- Serving as Principal Technology Advisor to a member of the California State Senate where he worked on public safety technology issues, as well as advancing the Open Data technology standard for state and local agencies.

Mr. Cruise will join the City effective Monday, August 6, however, he has already voluntarily participated in key meetings. His relevant experience in radio communications technology and related policy-making are expected to greatly benefit the City's efforts to deliver the best public safety grade performance to the Police and Fire first responders that rely on our critical communication systems to support their operations.

Communication with and Commitment from Vendor Team Harris/Daily Wells

To address the urgency of resolving radio system issues, the City Administrator has had two briefings in recent days with the Chief Executive Officers of both vendor partners—Daily Wells Communications Inc. (Daily Wells) and Harris Corporation (Harris). These two companies manufactured and constructed the P25 radio system.

In these briefings, the two company representatives are providing the City Administrator and key staff with a status of their work and presenting a daily work plan to fully address the findings and recommendations of the RCC Consultants' independent radio system performance evaluation report, as well as those issues raised by our first responders.

DIT, Daily Wells and Harris have fully acknowledged the concerns raised and have committed to identify and resolve these issues, and validate with first responders that their concerns have been addressed to their satisfaction.

Daily Wells and Harris have deployed a team of more than 20 top-notch system and software engineers with nationally recognized expertise who are working around the clock to thoroughly examine every component of the radio system, validate all the first responder complaints and reported problems, identify the cause(s), and implement corrective action to resolve recurrent issues with the system. The Harris Corporation's Director of Technical and Engineering support is working in the field in Oakland to personally direct the engineering team's efforts.

The objectives of the P-25 radio system team are to:

- Examine each reported problem with active/real-time trouble shooting
- Develop contingency plans as needed
- Leave no stone untumed in examining and resolving the radio issues

Key Radio Issues and Findings

The Harris/Dailey Wells (HDW) team has uncovered significant radio interference issues which are likely related to the "CC SCAN" occurrences which the team believes to be causing a significant amount of the audio problems that are being reported by our first responders. Finding and eliminating sources of radio interference is critical to improving the performance of the radio system.

The HDW team, working with DIT staff, is closely examining the root cause of this interference and notifying the necessary entities, including the Public Safety Bureau of the Federal Communications Commission (FCC), and other entities responsible for the public safety radio spectrum in our region.

The HDW team has identified and witnessed two causes of the occasional/intermittent "CC SCAN" in Oakland users' radios. Both causes involve outside interference which was validated by the team when they compared the actual "CC SCAN" complaints with the system logs.

The two causes have been identified as:

- GPS satellite signal interference
- Radio chahnel interference

Most P25 simulcast systems synchronize all their sites using GPS as a common reference. Now that the HDW team has identified the two causes referenced above, the team has imrhediately begun to look for potential options and solutions to address these causes and rectify the radio interference issues.

72-hour Plan

Over the next 72 hours, DIT staff and the technical team will:

1. Provide the City Administrator and key staff with potential options regarding the mitigation and/or correction of the "CC SCAN" issues related to the two causes. The recommendations will allow the City to make sound decisions about the appropriate and most effective correction actions.

2. Contact the FCC for their assistance in identifying and correcting interference problems.

3. Begin a single point of failure analysis to identify all potential components or issues that could lead to system failure and outline a strategy to mitigate potential problems.

4. Contact EBMUD to expedite their approval of plans to install a back-up power generator at one of the three radio sites.

In addition, the vendor team has been looking at:

- Field equipment
- System performance
- Interference (multiple interference incidents identified)
- Coverage
- Environmental concerns
- System maintenance

Over the next week, additional progress will be made in several areas:

- Continue to fix problems as the sources of the problems are identified.
- Complete the installation of a back-up power generator at a second radio site.
- Review coverage maps to develop additional solutions to enhance radio coverage.
- Present a detailed plan to fully address the findings and recommendations of the RCC Consultants' independent radio system performance evaluation report.
- Continue to brief the City Administrator on a regular basis until all problems are identified and resolved.

Status of Evaluating East Bay Regional Communications System Authority (EBRCSA)

Today the City Administrator received preliminary information that begins to address issues related to the option to join the regional public safety interoperable communications system (EBRCSA), including governance and cost. We will continue to work on a detailed cost/benefit analysis to thoroughly assess other issues related to migration to the new system, including the required change management process, training, operations, and maintenance.

Updates regarding progress made on resolving radio system issues will be forthcoming on a regular basis until the problems are resolved.

Respectfully submitted,

/s/
KEN GORDON
Interim Director
Department of Information Technology

ATTACHMENT D

DISTRIBUTION DATE: 7/17/12

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Ken Gordon

SUBJECT: Evaluation of P25 Public Safety Radio System Performance

DATE: July 17, 2012

City Administrator Approval /s/ Deanna J. Santana

Date 7/17/12

INFORMATION

The City of Oakland has released the findings and recommendations of an independent evaluation of the P25 public safety radio system performance. The evaluation was conducted by RCC Consultants, Inc., a global telecommunications and engineering firm specializing in the testing of Interoperable Radio Systems.

The purpose of the evaluation was to establish an operational baseline of the system as it currently exists so that a plan of action can be prescribed to resolve the issues experienced by the City's first responders. It is vital that our Police and Fire personnel are able to use the new system with a high degree of confidence.

The scope of the evaluation was to:

1. Measure current system performance against first responders' expectations and recommend near-term fixes and solutions that build confidence in the new radio system;
2. Develop an interoperability plan to ensure effective communications with our mutual aid partners and connectivity with regional public safety radio networks compliant with national P25 standards;
3. Analyze the City's existing operations and maintenance procedures and identify necessary changes to support the new system.

New P25 Technology Launched in June 2011

Oakland deployed new P25 public safety interoperable radio communications technology in June 2011. The P25 technology was designed to ensure interoperability with P25 systems in neighboring jurisdictions in times of emergency or when necessary in the course of daily

operations. The new digital technology complies with the national P25 interoperability communications standard.
The City's public safety radio "system" is comprised of a variety of systems and equipment that have evolved over nearly 20 years. These include: radio towers, electrical power systems, antennas, microwaves, radios, and dispatch consoles. The various components have been replaced or upgraded at different times since its original installation in 1993. As the evaluation report noted, "The upgrade to P25 technology was the latest step in a series of improvements over the years. Many aspects of the previous system still remain in place."

Prior to launching the new P25 technology, the City's first responders were equipped with an analog radio system that was nearing 20 years old and was experiencing well-publicized and significant service interruptions and periods of instability. Due to the urgency of addressing the issues related to our aging radio system, deployment of the P25 technology was accelerated. Although a regional interoperable system [East Bay Regional Communications Systems Authority (EBRCSA)] was in development, given the significant issues associated with the City's aging analog technology, it was not an option to wait another 12 – 18 months for the regional system to come on line.

Technical Issues Impede Adequate Performance of New System

Technical issues invariably arise from the deployment of new technology, especially with a system as complex as the new P25 technology. A number of upgrades and enhancements have been deployed over the past year to improve system performance: hardware upgrades; replacement of aging batteries; addition of a third P25 radio site to expand coverage; installation of in-building radio antennas to improve in-building coverage. The report noted that, "The upgrades represent partial, step-by-step upgrades to the system, not a complete system replacement."

Despite significant effort on the part of the City and its vendors to resolve identified problems, first responders have continued to report ongoing problems with the performance of the radio system. These problems have understandably undermined users' confidence in the new system.

The consultant noted that "failure of any component, even a headset jack, that affects the end users is perceived as a systems failure for users." A public safety communications system must be both reliable and perceived as reliable by the users. The evaluation determined that the system in its present form is not "public safety" grade. Although "the majority of transmissions are understandable with a minimum of noise or distortion, the list of user complaints and frequency of problems are too high for a modem public safety radio system."

Major Findings of the P25 System Evaluation

The consultant team interviewed police and fire personnel to gain a first-hand account of the problems first responders experience using the radios. Police and firefighters expressed concerns with poor coverage in some areas of the city as well as inside buildings, problems receiving and transmitting, unclear and varying audio levels, and problems with speaker mics.

The evaluation found that "numerous improvements are required in order to bring the Oakland P25 radio system up to the performance level of a typical urban or metropolitan Public Safety radio system." The report identified the most critical categories requiring improvement to be:

- Radio system coverage
- System reliability (back-up power and alarm systems)
- System maintenance and monitoring
- Accessory maintenance
- Training for users and radio technicians

Recommendations and Next Steps

The report identified five primary alternative solutions:

1. Do nothing; continue as-is
2. Upgrade current facilities
3. Expand existing system
4. Replace existing system with new City-owned system
5. Migrate to regional P25 system (EBRCS)

The evaluation team recommended that the City upgrade existing facilities in the short-term while developing a conceptual design and budget estimate to identify how many sites would be required to address coverage issues.

In parallel with this process, the City was advised to resume direct negotiations with the East Bay Regional Communications System Administration to identify the costs associated with joining the regional system, the level of coverage it would provide, and the level of control the City would maintain over its own operations.

Other recommended next steps included upgrading the City's Radio Shop equipment and training staff on P25 maintenance; and review and inspection of user equipment to address instances of poorly installed equipment, defective accessories and poorly tuned equipment.

Our police and firefighters put their lives on the line to protect this community, and a functioning radio system is their lifeline. City officials acknowledge and appreciate that they have experienced many frustrations with the deployment of this new technology, and staff is committed to work diligently and quickly to provide them with a radio communications system that meets their needs.

The City's Department of Information Technology staff will work with the consultant to examine the altematives identified and develop a cost estimate and timeline required to close the performance gap. The objective will be to achieve short-term (less than six months)

improvements to address gaps in performance where possible until long-term and more permanent improvements can be implemented.

Respectfully submitted,

/s/
KEN GORDON
Interim Director/DIT

For questions please contact Ken Gordon, Interim Director, at (510) 238-2023.

Attachment (1)

CITY OF OAKLAND
CALIFORNIA

P25 Radio System Evaluation Report

For Internal and Official Use Only

May 14, 2012

RCC Consultants, Inc.

May 14, 2012

Deanna J. Santana, City Administrator
Howard Jordon, Oakland Chief of Police
Teresa Deloach Reed, Oakland Fire Chief
Ken Gordon, Interim Director, Department of Information Technology
City of Oakland, CA

Ladies and Gentlemen,

Please find attached the RCC prepared P25 Performance Evaluation Report. This Report addresses RCC's findings in both the evaluation of user's perception, and actual RCC observations of the Oakland P25 Systems performance. In addition RCC conducted a citywide coverage and Bit Error Rate (BER) test that gives an indication of both coverage and signal content delivery.

RCC staff are available to discuss and present these findings at your direction. If you have any questions or comments, please feel free to contact me directly.

Sincerely,

Thomas Gray
Vice President & General Manager
RCC Consultants, Inc.
266 East 33rd Street
San Bernardino, CA 92404
(909) 881-0250
tom.gray@rcc.com

TG:amj

Section 1 Executive Summary

The City of Oakland, CA has retained the services of RCC Consultants, Inc. (RCC) to perform the following three tasks:

- Perform a Performance Evaluation of the City's P25 trunked radio system
- Develop an Interoperability Plan for communications with Oakland's neighbors
- Develop an Operations and Maintenance Plan for ongoing support of the City's radio system

Toward that end, RCC personnel have visited the following facilities:

- The Oakland Police Department Dispatch Center,
- The Oakland Fire Department Dispatch Center,
- The Piedmont Public Safety Dispatch Center,
- The Electronics Room at the Oakland Police Department Dispatch Center,
- The Electronics Room at the Oakland Fire Department Dispatch Center,
- The Electronics Room at the Piedmont Public Safety Dispatch Center,
- The Radio Site in the penthouse and on the roof of the American Presidents Line (APL) Building,
- The Radio Site at Seneca Reservoir,
- The Radio Site at Gwin Reservoir, and
- The Radio Shop at the Municipal Services Center (MSG).

RCC personnel have interviewed the:

- Oakland Police Department Dispatch Management,
- Oakland Police Department Dispatchers,
- Oakland Police Department Patrol Officers (at 12 shift changes),
- Oakland Fire Department Dispatch Management,
- Oakland Fire Department Dispatchers,
- Oakland Fire Department Radio Team Members,
- Oakland Department of Information Technology Management,
- Oakland Radio Services Management,
- Oakland Radio Services Staff,
- Dalley-Wells Communications Staff associated with the project,

- Bay Area Rapid Transit (BART) Communications Engineers, and the
- East Bay Regional Communications System (EBRCS) Executive Director.

1.1 Purpose of this Evaluation

The purpose of this evaluation has been to review the current state of the City of Oakland's P25 Radio System and assess its present condition and suitability for use by the City's public safety agencies.

This evaluation also includes a review of various means of communicating with neighboring agencies, to achieve communications "interoperability" with those agencies.

This evaluation also includes a review of the City's current Radio Shop's staffing, facilities and equipment, and makes recommendations for improving those facilities and capabilities.

1.2 What this Evaluation Includes

This report includes RCC's findings as a result of the site inspections and interviews listed in Section 1.1 along with documentation provided by the City regarding the various subsystems that make up the P25 Radio System.

This report also includes preliminary results from radio signal drive testing performed by RCC during the period from May 2nd to May 9th, 2012. During that period, RCC used test equipment installed in one of the City's Crown Victorias (a typical police patrol vehicle) to continuously measure signal strength throughout the City, using test equipment with antennas mounted on the trunk of the vehicle where police mobile antennas are mounted, and inside the vehicle where a portable radio antenna would typically be worn. Signal measurements include both composite simulcast signals (transmitted from all three sites simultaneously) and individual site signals (to help determine what coverage each site contributes to the whole). in addition, RCC also recorded Bit Error Rate measurements, which provide a more accurate picture of how clean a signal a digital radio "sees" in the Oakland area.

With the exception of the drive test performed in May, RCC's evaluation is based upon visual inspection of facilities, verbal information provided through the interview process and project meetings, and existing system documentation. The purpose of this phase of the project is to discuss the most likely causes and most likely solutions for the problems reported. RCC has not attempted to independently verify or troubleshoot the various problems that have been reported by the end users. RCC has not yet been involved in technical troubleshooting of those problems.

This evaluation provides a brief, high level history of the Oakland Radio System, it explains how the System evolved to its present state, it discusses the reported problems with the system, and it discusses alternative means to investigate, address or resolve those issues.

RCC discusses several approaches for improved communications available to the City, and evaluates each with respect to the following parameters:

- Relative Cost,

- Relative Coverage improvement,
- Relative Time required to implement,
- Level of interoperability provided with neighbors, and the
- Amount of Control the City could be expected to retain over its communications systems.

The amount of "Control" the City would have is assessed in terms of the amount of control the city would be expected to have over:

- Future costs,
- Number of talkgroups (functional channels) on the system,
- Priority Push-To-Talk access to the system,
- Ability to authorize and de-authorize access to City talkgroups,
- Amount of proactive system monitoring and alarm notification,
- Priority service response, and
- Service response time.

1.3 What this Evaluation is Not

This report does not include independent measurement or diagnosis of the problems reported by end users. This report relies upon information provided by the City, provided by the other stakeholders interviewed, and by RCC's visual inspection of the City's communication facilities.

RCC assumes that the incidence of problems reported is more frequent than the statistics provided, as RCC does not realistically expect every radio user to report every incident they experience. For the purpose of the evaluation, it is important simply to recognize that those conditions exist, and that they exist at least at the rates reported by the users.

RCC provides an evaluation of the pros and cons associated with the alternatives available to the City, but does not select any one approach as the recommended course of action. RCC believes that the City must weigh the critical issues of cost and control against the issues of interoperability and the degree to which the City's current problems would be addressed or resolved. The least cost solution is not the most effective solution, while the more effective solutions can be expected to require more time and money to achieve.

The course of action chosen by the City must be one that the City can afford, and must provide both short term relief and long term improvements for the system's end users.

1.4 Radio System History / Background

The City of Oakland's current 3-site P25 Trunked Simulcast Radio System configuration is the result of 19 years of evolution, and it continues to grow and change today. The current System (with a capital "S") is a combination of subsystems and components that have been procured and installed in stages since 1993. A full understanding of the current issues and reported problems associated with the City's radio system requires an understanding of how the City has

gotten to where it is today. in particular, it is important to understand which system components were installed when, along with an overview of who is maintaining those components.

During the course of RCC's interviews with Oakland personnel, it became apparent that most of the City's radio users were under the impression that the City's P25 radio system was a brand new radio system that would completely replace the City's older EDACS[1] system and eliminate any problems that they had experienced with the older system. in reality, the upgrade to P25 technology was the latest step in a series of improvements over the years. Many aspects of the previous system still remain in place.

1.4.1 The Oakland P25 Radio "System" is a collection of subsystems

The City of Oakland's Radio "System", much like similar complex systems in other cities consists of a collection of subsystems that include but are not necessarily limited to the following:

- Radio Tower Sites;
- Equipment Shelters at the sites;
- Environmental Control Systems;
- Grounding and surge protection systems;
- Primary Electrical Power Systems;
- Backup Power Systems;
- Transmit and Receive Antenna Systems;
- Microwave and other connectivity systems;
- Alarm Systems;
- Radio Repeaters;
- Dispatch Consoles;
- Console Furniture;
- Network Controllers;
- Simulcast Synchronization Systems;
- interoperability Gateways;
- Mobile Radios and Accessories;
- Portable Radios and Accessories;
- Desktop Control Stations and Accessories;
- in-Building Bi-Directional Amplifier Systems, and a
- Voice Logging Recorder System.

Each of the above subsystems can be broken down further into smaller subsystems or components.

[1] ("EDACS" is a Harris product name for "Enhanced Digital Access Communication System".)

A failure of any one of those components or subsystems can potentially keep the end user from being able to communicate with other users or with dispatch.

1.4.2 Evolution of the "System"

The "System" has evolved over time, with various subsystems being replaced or upgraded at different intervals. The following outline represents RCC's understanding of the evolution of the City's trunked radio system from its first installation as a single tower site analog EDACS system in 1993 to its present configuration as a 3-site, 10-channel P25 digital simulcast system.

in 1993, the City installed a new EDACS trunked radio system on the American Presidential Lines (APL) Building rooftop. The APL site, which was intended to serve the majority of the City, was equipped with 14 radio channels. The City later added a site at the East Bay Municipal Utility District's Seneca Reservoir. The Seneca site, which was intended to serve units in the southeast portion of the City that could not reliably reach the APL site, was equipped with 5 radio channels.

in 1999, the City upgraded the "brains" of the system to a dual controller configuration as part of a Y2K upgrade. The City also installed new C3 Maestro dispatch consoles at that time.

in 2006, a number of upgrades were performed:

- A three-channel standalone P25 site was added at the East Bay Municipal Utility District's Gwin Reservoir site, which sits on high ground along Grizzly Peak Blvd, overlooking much of Oakland and the Bay Area.
- The City also performed an upgrade to its Communications System Director (CSD), which is the system administration package used to access and control / manage the radio system.
- That year the City also installed a "Stargate" to interface or "link" the Oakland system to neighboring EDACS systems in Richmond and at BART, allowing users from one system to talk to users on the other system. The Stargate was intended to facilitate better radio communications interoperability between the three cities, but the Stargate link is no longer active. The Stargate interface is being replaced by a new Harris ISSI interface.
- The City upgraded the equipment that is used to select the best incoming radio signal from the tower sites (called a voting comparator), and upgraded the radio repeaters (the base stations) at APL from the old MASTR ii series to the new MASTR iii series.
- The City added a single-channel site at Fire Station 28 to provide additional coverage in the far southeast corner of the city, in the Golf Links Road area east of 580.

in 2006 the City also managed to use the FCC's 800 MHz Rebanding mandate to its advantage, by replacing and upgrading older user radios (at Nextel's cost) with newer P7100s and P7200s. (The FCC Rebanding Mandate instructed licensees to retune their systems, at Nextel's expense, in order to minimize interference between Nextel's transmitter sites and public safety systems.)

in 2008, a single 3 channel P25 pilot radio site was installed at the Gwin Reservoir site.

In 2010, a number of problems with the City's aging EDACS system forced them to accelerate their conversion to a new P25 digital system.

In 2011, the City completed the following:

- Rebanding retune of its radio infrastructure;
- Upgraded the APL and Seneca sites to a P25 digital simulcast system;
- Upgraded its dispatch console computers to Harris' new IP version of Its C3 console system (C3IPs); and
- Installed a new Aviat 11 GHz microwave network to connect the sites and dispatch centers.

The P25 simulcast system went live in June 2011. Unfortunately the launch of the P25 system was accompanied by a number of Initial problems due to a software mismatch between the user radios and the radio Infrastructure software versions. These problems created a very poor first Impression of the new system, an Impression that still lingers to this day.

The launch of the P25 system was also accompanied by the users' expectations that the conversion to P25 digital operation would take care of or correct all of the problems associated with the old EDACS system, even though no new sites were being added to the system. Consequently, user disappointment that they still had many of their old dead spots and trouble areas was significant.

In late 2011, the City swapped out old portable radio batteries that had been kept in use for several years beyond their normal lifecycle with newer, longer-lasting Lithium Polymer batteries. Batteries for public safety radios should be swapped out every year or two depending upon their rate of use. Prior to replacement of the batteries, battery failure was among the main contributing factors to the poor handheld radio performance.

In 2012, the City converted the standalone Gwin Reservoir P25 site to a simulcast site, making the system a 3 site simulcast system. The City also expanded the simulcast sites from 7 to 10 channels to increase system capacity.

Other upgrades by the City are currently planned and ongoing, such as the addition of backup power generators at the Gwin and Seneca sites, and the installation of a new logging recorder system.

It should be noted that the growth and migration of the Oakland system over the past decade was performed using grant funds and other sources as the funding became available. The City reports that it has never incurred debt by Issuing bonds or borrowing funds for any of the work performed on the system.

It should also be noted that the upgrades represent partial, step by step upgrades to the system, not a complete system replacement.

At no time since 1993 has the entire system actually been re-engineered or replaced at the same time as part of a single program. As a result, after each "upgrade" step along the way some components of the System have been brand new, while some older equipment remained.

in many instances, the aged components begin to present problems that affected the system as a whole.

For example, when the P25 System went live in June 2011, the Seneca site shelter, tower, grounding systems, antenna systems, power systems and alarm systems were still as they had been when the site was first constructed. One system performance problem was later traced back to a bad antenna, whose radome had collected water, shorting out the antenna elements.

A couple of other problems at the Seneca site were related to the lack of backup power systems. A backup UPS was installed in 2011 after the system went live. A backup power generator is presently waiting to be installed.

While the dispatch consoles in the dispatch centers have been upgraded with new computers and dispatch software, some of the supporting accessories are older or original equipment, such as the audio cabling, headset jacks, foot pedals, display monitors, and speakers. The headset jacks in particular have been reported to be problematic, as they are now so worn out that they no longer make a solid connection with the dispatcher's headset. These loose connections can result in audio problems that are perceived to be "part of the system".

As noted earlier, the batteries that were in use when the City cut over to the P25 system had exceeded their useful life, and were contributing to user complaints about the system. Those batteries were replaced in October 2011.

The following list gives an overview of which system components are still relatively old, and which components are newer. (Note that items like infrastructure components – shelters, towers, etc. typically have a longer useful life than electronic components or accessories):

Components aged more than **5** years:

- APL equipment room
- Seneca equipment shelter
- Seneca radio tower
- Seneca antenna systems
- Backup power generator (or lack thereof) at Seneca (being installed in 2012)
- Alarm and notification systems / sensors, etc.
- Voice logging recorder system (being replaced in 2012)
- Dispatch consoles at Piedmont (being replaced in 2012)
- Dispatch console accessories (furniture, headset jacks and wiring, foot pedals)
- Desktop radio antenna systems
- Mobile radio antenna systems
- Mobile radio power harnesses
- Portable radio accessories

intermediate aged items installed as part of P25 pilot or Rebanding (2 to **5** years old):

- Mobiles and portables replaced as part of Rebanding
- Combiners replaced as part of Rebanding
- APL antennas and line
- Gwin equipment shelter
- Gwin radio tower

Gwin antenna system

Newer items installed as part of P25 Upgrade (2 yrs old or less):

P25 Digital Repeaters
P25 Backbone Electronics
Radio Dispatch CPUs and Software at Police and Fire Dispatch Centers
Aviat Microwave System

Items less than 1 Year old (installed after the P25 System cutover):

UPS systems at Gwin and Seneca
Portable radio batteries
Air conditioner at Gwin
Gwin simulcast equipment
Second transmit antenna and line at Gwin
Replaced combiner at Gwin
BI-Directional Amplifiers for PAB and Eastmont PD substations

1.5 Summary of Major Findings of the P25 System Evaluation

As noted in the previous section, the P25 Radio "System" is really a collection of subsystems, each of which play a role in the overall performance and reliability of the City's radio system. RCC made a number of observations regarding opportunities for improvement in the City's communications facilities and end user equipment, which are covered In more detail in the body of the report. RCC also noted opportunities for improvement in the Radio Shop's equipment and support capabilities.

The City's Radio Shop and IT department has continued to work on Improving the Radio System during the course of RCC's evaluation. Consequently, solutions for a number of these Identified opportunities for improvement may have already been implemented or may currently be underway.

Overall, RCC finds that numerous improvements are required in order to bring the Oakland P25 radio system up to the performance level of a typical urban or metropolitan Public Safety radio system.

The most critical categories of improvement needed to bring the system up to typical Public Safety standards of performance fall into the following categories:

- Improvements in radio system coverage;
- Improvements in system reliability (currently primarily backup power systems and alarm systems);
- Improvements in system maintenance and monitoring (more frequent monitoring of system performance conditions and improvements in alarm alerting capabilities), and
- Improvements in subscriber (user radio) and subscriber accessory maintenance.

There is some overlap in the above categories, as some of the identified opportunities for improvements to the sites, subscriber equipment, and maintenance program will result in improvements to the overall coverage of the radio system.

The primary end user complaints from the Oakland Police and Fire Departments are related to audio problems and an inability to access the system (get on the air) when needed. These complaints typically fall under the category of "coverage issues", though there may be a number of other root causes in addition to the coverage provided by the system's tower sites, such as:

- Weak radio batteries reducing the range or coverage of portable radios (batteries were replaced for most public safety users last fall)
- Broken or defective accessories (broken speaker mics, loose connectors, damaged antennas on portable or mobile radios)
- Local sources of radio frequency (RF) interference (from local cellular sites, for example)
- Portable or mobile radio equipment out of tune or out of alignment
- Portable or mobile radio equipment software mismatch with system
- Mobile radio installation problems (such as loose connectors, lack of proper equipment grounding, lack of ground plane for the antenna, broken antenna, etc.)

Coverage related problems have significant effect on officer safety, as the ability to coordinate backup or warn fellow officers of a hazardous situation is of critical importance. Public safety personnel told RCC that lack of coverage, or even lack of confidence in their radio equipment, can have an impact on the way they perform their jobs.

Coverage-related User complaints have been described (and tracked) by the Police Department under the following descriptions:

- CC Scan (radio unavailable looking for a control channel);
- Cutting in and Out;
- Dead Spots;
- Failed Radio;
- Poor Reception;
- Poor Transmission;
- Radio Problems;
- Unable to Copy Radio;
- Unable to Receive Radio, and
- Unable to Transmit.

The OPD also tracked incidents of "bleed over", where audio (communications) was heard on the wrong channel, and "Other", which represents a miscellaneous problem category other than the categories above.

RCC attended a total of 12 shift changes in order to hear about Oakland Police Department patrol officers' experiences first hand. The following is a partial list of the more specific complaints that officers voiced about their experience with the radio system:

- Poor coverage in foothills;
- Poor coverage inside buildings (hospitals, PAB basement, buildings in various parts of the City, etc.);
- Users perceive that the system works better outside the city than inside;
- CC SCAN appears randomly. One officer noted LESS occurrence of CC SCAN while testing the single-site GWIN system than he normally sees when operating on the simulcast system. Officers report mobiles frequently in CC SCAN when portables are not;
- Radios take a long time to register (stay in CC SCAN a long time after powering up);
- Radio picking up traffic on other channels;
- Radio transmitting on wrong channel;
- Radio switching on its own to another channel;
- Variable incoming audio levels, especially between different radio types (mobile, console, portable);
- Fellow officers can hear transmissions, but dispatch does not respond;
- Radio lack of backlight (or at least backlight option) on portable radios. Patrol officers want backlight ON by default, with ability to turn it off when needed;
- When siren is on, officers are unable to transmit;
- Speaker mics pop off radios (Cracked retention slots, screws not tight enough);
- "Speaker mics work GREAT accidentally, but not when the officer needs to use it". (One officer noted that if he accidentally sits on the microphone, the whole world will hear every word he says. But if he's in a struggle or a pursuit, then no one can understand what he's saying);
- Speaker mic PTT button is fussy – has to be pressed in just the right spot in order to key up the radio;
- Users report that the longer you key the mic, the weaker the transmission becomes. (potential battery problem);
- Users would like a louder, more distinct talk permit tone;
- One officer noted that radio buttons are pressed by radio holster if user transmits while running. (Interferes with voice audio);
- Several users reported getting shocked when hanging up the mobile mic in the microphone clip, and
- Mobiles "freeze up" when changing channels – have to power off, then on, in order to reboot the radio.

RCC personnel made a few other observations (listed below) during their visits to Oakland.

- System alarm system limited in its capabilities; limited site alarms; no ability to automatically ALERT on-call technician when a problem arises.
- [redacted]
- [redacted]
- The old EDACS Analog System is the backup radio system
- Many users are not aware that they have talk-around (direct unit to unit) channels in their radios, which would allow them to talk to each other radio-to-radio when they are close to each other but are beyond the range of the system (such as when one officer is inside a building and the other is outside).
- Radio channel (selection) programming in the user radios is horrendously and unnecessarily complex. It was very difficult to navigate to interoperability channels and back using radios as they were configured at the end of 2011.
- No "cheat sheet" provided. Larger organizations whose radios have many systems and talkgroups programmed into them give their officers a small laminated "cheat sheet" card that serves as a menu to help them find their way through the matrix of systems and channels that are programmed into their radios. Some attach the card to a flat surface on their radio, while others attach the card to the same clip that holds their ID and magnetic security card.
- No "Home" button programmed to quickly and easily get users back to their dispatch channel. A "Home" button is a very helpful way to get a user back to their primary channel when they get lost in the multitude of systems that are programmed into their radios.
- End user training inadequate. It is RCC's understanding that the subjects of proper radio usage, radio etiquette, and radio protocol for routine, emergency, and multi-agency situations are not presently taught at the police academy, and most officers get their information regarding the proper use of the system from periodic instructional e-mails.

The site and alarm system issues are addressed in more detail in Section 3 and Section 12.

It should be noted that despite the long list of user complaints and the additional observations made by RCC, the vast majority of transmissions on the system are clear and understandable.

However, it is critically important that steps be taken to make sure that public safety personnel are able to communicate clearly and reliably wherever and whenever they key their radio.

1.5.1 Radio Coverage Testing

There are a number of steps that can be taken in an effort to diagnose radio coverage problems. One of the first steps is to measure the strength of the radio signals delivered by the system throughout the City. RCC performed a signal strength drive test in May 2012 in an attempt to determine to what extent the City's radio coverage problems are simply the result of not having enough tower sites to provide the level of coverage required by the City. The data from those drive tests is discussed in the body of the report in Section 6.

Coverage performance is typically defined in terms of the percentage of the radio system's desired service area that is covered for a specific radio usage type (95% of the service area is a typical coverage specification for public safety radio systems). For example:

- Mobile Coverage - Mobile radio coverage is the type of coverage provided when using vehicular (car) radios. These radios are more powerful than smaller handheld portable radios. Typically, mobile radios have about ten times the transmitter power of handheld radios and they also have a much better antenna which is mounted on the exterior of the vehicle. Consequently, mobile radios provide substantially better coverage or "communications range".
- Portable Coverage - Due to the reduced "range" of handheld radios, portable radio coverage is more difficult to provide. Coverage in buildings is tougher to provide than coverage outdoors on the street because the building structure blocks some of the radio's signal. Heavier buildings exhibit more signal loss than smaller buildings. The amount of loss is measured or quantified using a term called the decibel (dB). A higher building loss has a greater reduction in the radio's ability to communicate within the facility. For the purposes of this report there are typically three levels of portable coverage discussed, which are described as follows:
    - Portable Coverage Outdoors On-Street (no building loss): Assumes the radio user is outdoors in a relatively average environment. Typical vegetation and local terrain are accounted for. This category does not include the use of a portable radio inside a vehicle.
    - Residential In-Building Coverage (up to 10 dB of building loss): Examples of buildings in this category may include convenience stores, gas stations, fast-food restaurants, small single-story homes/businesses, and other establishments with numerous windows or extensive glass exteriors.
    - Commercial In-Building Coverage (10dB - 20dB of building loss): Examples of buildings in this category include light to medium construction buildings such as medium size businesses with windows, small to medium size schools, etc. It may include some heavy buildings with numerous exterior windows that allow radio signals into the building. Radio signal levels are the strongest near the tower sites, and that is generally where you will have the best in-building communications.

Analysis of RCC's May 2012 test provided the following levels of radio coverage for each of the usage scenarios in Figure 1.5.1.

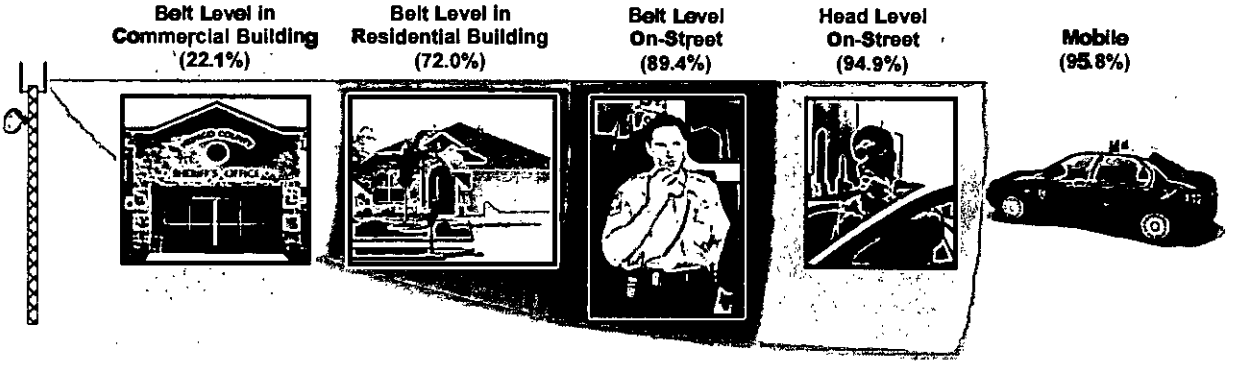


Figure 1.5.1 – Usage Scenarios for Portable and Mobile Radios

Some agencies hold the radio at head level during use, while other agencies, including most public safety agencies, wear the radio on the belt with an extended microphone on a cord. Elevating the radio to head level improves coverage because the radio's antenna is higher above the ground and the antenna is less obstructed by the user's body. Placing the radio on the belt decreases coverage due to the lower placement of the antenna and the signal blockage by the user's body. How the portable radio is used makes a significant difference is therefore an important factor in assessing coverage performance.

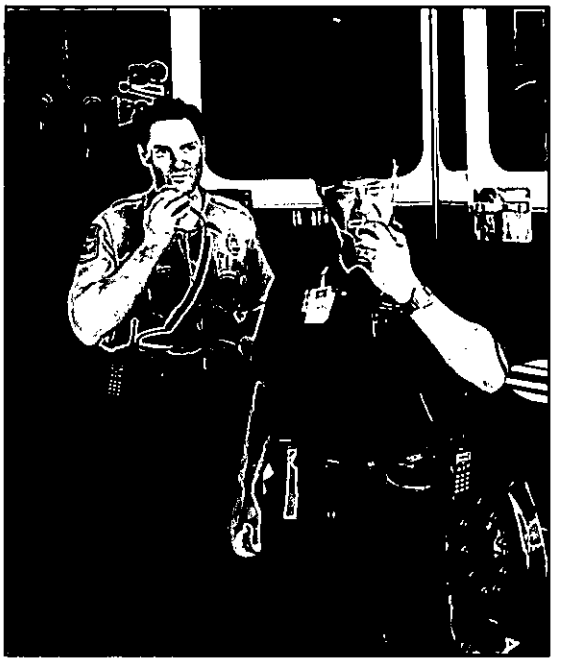


Figure 1.5.2 – Use of Portable Radio at Hip Level

Drive tests performed by RCC in May 2012 indicate that the current three site simulcast design provides enough signal within the Oakland service area to provide the following levels of coverage for the listed radio usage scenarios:

Usage Type	Target Signal Level	Percentage of Area Covered
Mobile at Trunk Level	-108 dBm	95.8 %
Portable at Head Level	-105 dBm	94.9 %
Portable on Belt	-95 dBm	89.4 %
Portable on Belt in 10dB Building	-85 dBm	72.9 %
Portable on Belt in 20dB Building	-75 dBm	22.1 %

For this test, "the Oakland service area" was defined as the land areas within the City limits of Oakland, Piedmont, Emeryville, and Alameda.

The drive test results indicate that approximately 95% of the service area has enough signal to provide clear communications to both mobile radios and to portable radios held at head level. Better than 89% of the area is covered for a portable at belt level outdoors. Approximately 73% of the area has enough signal to provide coverage to a portable on the belt inside a residential building, and approximately 22% of the area has enough signal to provide coverage inside medium commercial buildings.

However, RCC's drive tests also indicate that there are a number of points within the service area where sufficient signal levels exist, yet for various reasons the digital signal has an elevated rate of bit errors (meaning the signal suffers from some form of distortion or interference). The cause or source of that interference or distortion has not yet been determined, but should be investigated by the City or by RCC in a future phase of this project. Section 6 contains a more detailed discussion of the drive test results and what they indicate.

1.6 Summary of Interoperability Study

Following the events of September 11, 2001, and the clear negative operational impacts that ineffective communications had on a coordinated multi agency response, the nation became focused on improving public safety radio interoperability. it is important to draw a distinction between public safety and emergency management and response. in broad terms, public safety involves the protection and prevention from events that could endanger the safety of the general public. Our public safety first responders, and the culture of these agencies is to be "ever vigilant" to ensure that the citizens served are protected. Public safety involves monitoring, proactively preventing, and responding in such a way that the citizens served are safeguarded. individual law enforcement and fire agencies traditionally oversee the citizens that are commissioned to "preserve and protect". The core of public safety is the receipt of calls for service (9-1-1), and the dispatch of services and an internal coordination of that response. This public safety activity goes on routinely each day in cities and counties throughout the Country. Typically the need for real time incident coordination between agencies, radio interoperability, is not needed to ensure effective public safety services; this is reinforced and reflected in the current culture of the public safety community.

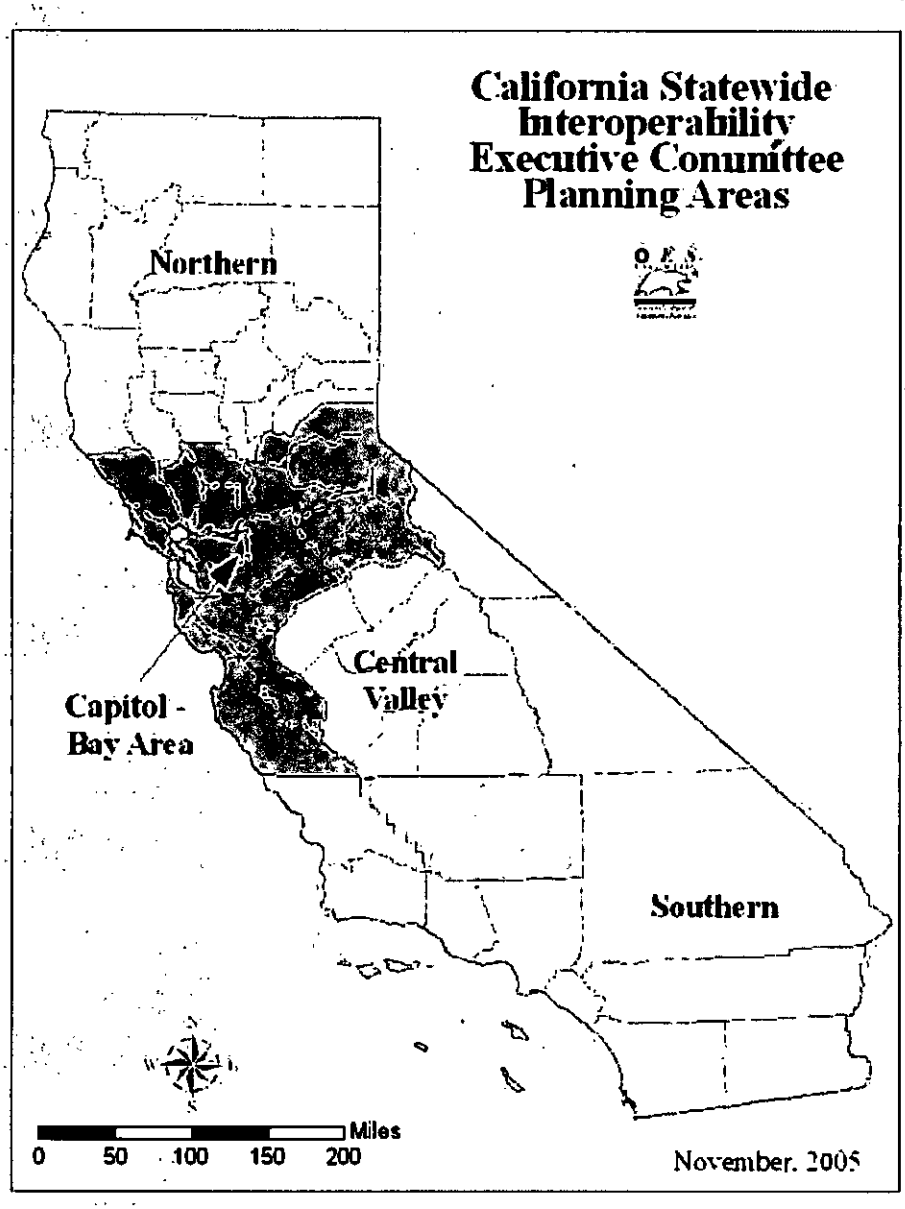
Emergency Management however is a strategic approach to larger events unlike the tactical public safety daily oversight. This is not to say that public safety does not have a strategic aspect to preparedness and prevention of crime and fire response, it does. Emergency Management is the strategic response that requires interoperability between multiple agencies regionally and even nationally to ensure a well-coordinated response and recovery. This is where radio interoperability becomes essential. In response to the events of 9/11 the Department of Homeland Security (DHS) was put in place and an initiative put in place to improve radio interoperability between first responders, not necessarily impacting day-to-day public safety services, but to address mitigate and prepare for major disasters and catastrophes that require interagency coordinated Emergency Management. The DHS created a program initiative called SAFECOM, as part of the Nation's first strategic plan to improve emergency communications SAFECOM addresses an approach that recognizes the reality that this process will be evolutionary in nature and addresses radio interoperability in terms of governance, operations, technology, training and exercises, and usage. There is not a technological distinction between public safety infrastructure and its use in support of an emergency management event; therefore it is the responsibility, especially for large urban areas such as the City of Oakland, to provide an effective interoperability solution for operations regionally.

Emergency Management however is a strategic approach to larger events unlike the tactical public safety daily

The 2007 California State Interoperability Communications Plan (CalSCIP) has adopted the following vision for interoperability in the State:

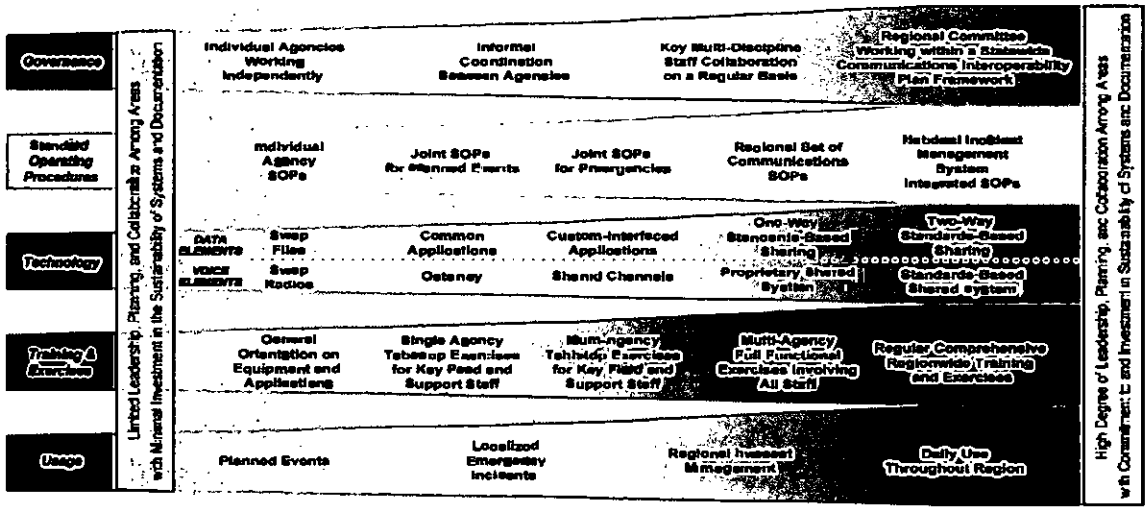
> *"to ensure all local, regional, tribal, state and Federal public safety first emergency responders and designated public service organizations operating within California will be able to communicate in real time, across disciplines and jurisdictions, to respond more effectively during day-to-day operations and major incidents by 2017."*

Toward that goal, California has established regional interoperability planning regions, of which Oakland falls into the Capital-Bay Area Planning Region.



California's statewide communications interoperability effort is coordinated and implemented by the California Emergency Management Agency (Cal EMA) and is guided by the State Communications Interoperability Plan (CalSCIP). Through the California State Interoperability Executive Committee (CalSIEC), and the Public Safety Radio Strategic Planning Committee (PSRSPC), which receive guidance from stakeholder groups, regional planning committees, public service and private sector groups. Through collaboration, both the CalSIEC and the PSRSPC work toward moving the State forward in achieving sustainable interoperability along the lanes of the Interoperability Continuum.

SAFECOM Interoperability Continuum Chart



When following the SAFECOM Interoperability Continuum, the highest levels of interoperability are possible by achieving success In each of the Continuum lanes. Greatest levels of success are achieved when there is regional cooperation to implement a shared, standards based, interoperable communications system.

There are a number of technologies available to allow agencies to communicate with each other. The most common solutions used by public safety agencies are:

- Swapping Radios
- Cross-patching systems and channels (consoles patches, gateways, etc.)
- Cross-Programming User Radios with other agencies' systems and channels
- P25 System Level Interfaces – ISSI
- Shared Mutual Aid Overlay System
- Shared Networks / Regional System

Each technology is discussed In more detail in Section 10 of this evaluation. In general, the highest level of Interoperability occurs when all users share the same radio system and have access to common channels on that system.

Pros and cons of each approach are also discussed in Section 10.

1.7 Summary of Operations and Maintenance Plan

The City's radio shop is currently responsible for directly maintaining or overseeing the maintenance of the following systems:

- P25 Simulcast Radio System (Post – warranty support),
- 11 GHz microwave system (Post – warranty support),
- Dispatch console system,

- Radio system logging recorder,
- 19 GHz Harris Farinon Microwave System,
- EDACS Multicast Radio System,
- Public Safety Mobile Data Systems,
- VHF Interoperability Radio Systems,
- Wireless networks used to support City facilities,
- Closed Circuit Television Systems for all City facilities,
- 29-Site Outdoor Warning System,
- Mobile radio installations for public safety departments,
- User radio first echelon troubleshooting and repairs for mobile and portable radios, and
- User programming and template development for all radio users.

Currently there are five (5) technicians employed by the City that in conjunction with some other Information Technology (IT) personnel and some vendor support are responsible for maintaining each of these systems on a 24 hour, 7-days a week basis. The field service technicians are expected to be familiar with each of the systems maintained by the shop. There is some specialization where certain techs are more familiar with some of the systems than others. In many circumstances, technicians will work on systems that they are more familiar with such as fixed radio infrastructure repairs vs. bench repairs.

Field Service includes responding to service on equipment located throughout the City. There is one (1) service van that Is equipped with small miscellaneous installation hardware and a few replacement parts. Test equipment is not left in the van, but rather the technician will determine what test equipment is likely to be needed depending on the nature of the call, and then borrows that test equipment from the shop. The majority of spare parts and other installation hardware are stored In the parts room located in the radio shop.

The primary deficiencies Identified with current Radio Shop operations are:

- Inadequate staff training on the new P25 portions of the system
- Inadequate test equipment for working on the P25 system
- Room for improvement in internal shop communications
- Room for improvement in Equipment and Service Call Tracking
- Need for pro-active Site Monitoring / Alarm Alerting
- Insufficient spare parts inventory on-hand

Section 12 of this report provides an Improvement Plan to address each of the above deficiencies. Section 12 provides a recommended staffing plan, spells out the training needed for shop personnel, the test equipment they will need, and procedures for better tracking their work volume.

1.8 Summary of Alternative Solutions

There are 5 primary alternatives available to the City of Oakland:

1. Do Nothing; continue As-Is
2. Upgrade Current Facilities
3. Expand Existing System
4. Replace Existing System with new City owned system
5. Migrate to Regional P25 System (EBRCS)

The above solutions are not necessarily exclusive, and it may be prudent to implement some needed short-term solutions while working on the longer range solutions.

The primary differences between these alternatives fall under the headings of:

- Cost;
- Coverage;
- Control;
- Time required to implement, and
- Interoperability.

Do Nothing; Continue As-Is

The "Do Nothing" approach preserves the status quo, and does nothing to address the users' complaints or the identified opportunities for improvement. This option is appears to be the least expensive to implement, and requires no time to do so. That said, system problems represent risk to the City and its employees. Interoperability with neighbors remains unchanged. Control of the system remains with the City as today.

Upgrade Current Facilities

The "Upgrade Current Facilities" approach will address a number of "easy to fix" problems without adding additional tower sites to the system. Depending on the extent of the upgrades, and large number of root causes of current user complaints and opportunities for improvement could be addressed. This approach will require some time and money to implement, but not likely as much as would be required to add sites or replace the entire system. The primary disadvantage to this approach is that it does little to improve the level of coverage within the City – dead spots would remain.

Expand Existing System

The "Expand Existing System" option, if chosen, should include upgrades to existing facilities in order to eliminate as many of the root causes of user complaints as possible. This option will require more time and money to implement than the previous alternatives, but may cost less than a full system replacement. The primary advantage of this alternative is that additional

sites, if properly designed and selected, should make a significant improvement in system coverage.

Replace Existing System

The "Replace Existing System" option provides the most comprehensive remedy for the problems identified in this evaluation. This option should include careful development of specifications for a new system, and a competitive bidding environment to minimize costs and ensure the most favorable terms for the City. This option can provide the optimal solution to the City's coverage problems, subject to the City's financial ability to procure and maintain additional sites. This solution also provides the most comprehensive means to eliminate problems caused by equipment and subsystems of differing vintage and condition. The most complete solution to these problems, however, also involves the highest cost and the greatest amount of time to implement, which would require a minimum of two years to carry out after the design is completed and funding is secured. Upgrades to existing facilities may be required in the meantime to address the more pressing problems of the current system.

Migrate to Regional P25 System

The "Migrate to Regional P25 System" is a different alternative that will require further exploration in the form of both: a) negotiations with the East Bay Regional Communications System Administration (EBRCSA), and b) testing of the EBRCS system in the Oakland service area. Negotiation with EBRCSA is the only way to ascertain precisely what participation in the regional system would cost the City, and how much control the City would be able to preserve over its own operations. The current EBRCS design includes 4 simulcast sites where the City presently has 3, plus a fifth standalone site at Gwin which would also provide coverage in Oakland's service area. Whether the EBRCS site configuration will provide an acceptable level of coverage or merely an incremental improvement remains to be seen, and should be tested by Oakland once the system is on the air and accepted by EBRCSA. in particular, the City will want to assess whether or not the one additional site above Skyline Blvd makes a difference in providing in-building coverage in the central portions of Oakland, where users currently complain of limited in-building coverage. The City should participate in EBRCSA's acceptance testing of the Oakland area cell this summer. The primary advantages of this alternative is that it provides the highest level of interoperability with Alameda County agencies and neighboring Cities that join the EBRCS system, and should take less time to implement than replacing the City's own system.

The City's involvement with the EBRCS system could take a number of forms, depending upon arrangements negotiated with EBRCSA. The three main variations are:

1. Simply program Oakland Public Safety Radios to operate on the EBRCS system for interoperability purposes, while preserving the Oakland system for primary day-to-day operations.

2. Connect the City of Oakland P25 system to the EBRCS system through either an iSSi interface or as a cell of the EBRCS network. This option would keep the City's system and dispatch facilities intact, while allowing users to roam onto the rest of the EBRCS system when outside of the Oakland radio system's coverage area.

3. Merge the City of Oakland's assets with the EBRCS network, and begin using the EBRCS system for primary day-to-day operations. Precisely which assets would make the move to the EBRCS system would need to be negotiated with EBRCSA, but all of the City's current assets should be discussed, including but not limited to mobiles and portables; tower sites and tower site equipment; backbone connectivity; dispatch center and EOC equipment; Radio Shop facilities, capabilities and equipment; and Oakland frequencies and licenses.

With each of the above EBRCS options, the details regarding cost, coverage, and control will need to be determined through both negotiations and testing. The City will also want to closely examine and evaluate the technical details regarding the EBRCS system's design and construction so that they understand any and all pros and cons of the Regional system design and operation.

The table below illustrates the relative pros and cons of the primary approaches available to the City of Oakland:

Alternative	Cost	Coverage	Control	Time	Interoperability
Do Nothing	Least Expensive	No Improvement	Full Control	No time required	Same as Today
Upgrade Current Facilities	Modest Expense	No Improvement	Full Control	Short time	Same as Today
Expand Existing System	Expensive	Major Improvement	Full Control	Intermediate	Same as Today
Replace Existing System	Most Expensive	Major Improvement	Full Control	Longest	Same as Today
Migrate to Regional System	TBD	TBD	TBD	TBD	Full Interop

Color Key:

- Pro
- Relative Pro
- Neutral
- Relative Con
- Con

RCC recommends that the "Do Nothing" approach be ruled out, for obvious reasons. "Doing Nothing" allows the noted deficiencies to persist, with greater risk of undetected system problems.

RCC recommends that the City take steps to upgrade existing facilities in the short term, while proceeding with the Conceptual Design and Budgetary Estimate phase to develop a clearer picture of how many sites would be required to address Oakland's coverage issues. At the same time, Oakland should re-engage EBRCSA in direct negotiations to iron out issues of cost and control associated with the City's participation in the new system.

in 2010 and 2011, the Alameda Grand Jury performed an investigation into reported problems with the City's aging EDACS radio system. in their report they made a number of recommendations for improving the City's radio system and for improving regional interoperability between City and County agencies. On page 31 of their Report, they noted that discussions between the City and County regarding improving interoperability between the two agencies had broken down, and they recommended that the City and County resume discussions towards that goal:

> "The Grand Jury concludes that accommodations must be made both by EBRCSA and by Oakland. it does not seem reasonable to expect Oakland to change its vendor or completely abandon the new system they are building. The funding formula for Oakland may need to be different than that for other cities in order to motivate Oakland's full participation."

The City should also participate in coverage testing of the ALCO Northwest simulcast cell, which should include both voice testing and drive testing. Drive testing should include both signal measurement and Bit Error Rate (BER) measurement, similar to the tests of the city's own system in May 2012.

1.9 Recommended Next Steps

RCC recommends that the City's key decision makers read the remainder of this evaluation in detail, to obtain a more complete understanding of the issues identified by RCC and the proposed solutions. RCC recommends the City take the following additional steps:

Recommendation 1:

RCC recommends that the City take steps to upgrade existing facilities in the short term. Priority improvements should include backup power systems and site alarm systems with alerting capabilities.

Recommendation 2:

The City should proceed to the Conceptual Design and Budgetary Estimate phase to develop a clearer picture of how many sites would be required to address Oakland's coverage issues.

Recommendation 3:

At the same time, Oakland should enter into direct negotiations with EBRCSA to iron out issues of cost and control associated with the City's potential participation in the new system.

Recommendation 4:

The City should participate in coverage testing of the ALCO Northwest simulcast cell, which should include both voice testing and drive testing. Drive testing should include both signal measurement and BER measurement, similar to the tests of the city's own system in May 2012.

Recommendation 5:

The City should immediately take steps to upgrade the City's Radio Shop's equipment and to train its personnel on the maintenance of the new P25 system.

Recommendation 6:

The City should implement a fleetwide review and inspection of subscriber equipment to clean up lingering issues with unsatisfactory equipment installation, defective accessories, and poorly tuned equipment.

Recommendation 7:

City employees should participate in the next end to end Preventive Maintenance (PM) program of the P25 radio system backbone, and must be trained and equipped to perform a full system PM on their own.

ATTACHMENT E

DISTRIBUTION DATE: 1/31/12

CITY OF OAKLAND

City Administrator's Office

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Deanna J. Santana

SUBJECT: P25 RADIO SYSTEM IMPLEMENTATION UPDATE

DATE: January 30, 2012

INFORMATION

The purpose of this Information Memo is to provide an update on the new P25 public safety radio system as reported by the Department of Information Technology (DIT). This report provides an updated status since the Information Memo issued on December 12, 2011 and includes current information regarding system performance, system improvements and planned implementation activities and strategic objectives for moving forward.

System Performance

The Police and Fire Departments continue to track daily incidents related to portable and mobile radio issues. The P25 Radio Problem Incident Report (Attachment A) includes the most recent portable and mobile radio incidents reported from January 1, 2012 through January 15, 2012 and are based on the first responder's user of the radios during daily field operations.

The number of incidents of "CC Scan" is still unacceptable and will be addressed in the coming weeks. "CC Scan" is a condition which alerts the radio user that they have lost communications because they are in an area where there is no radio signal (i.e. a "dead spot"), or the radio signal in the area is too weak for effective communications. Initially powering on the radio or having a weak or faulty battery can also cause a "CC Scan." The "CC Scan" issues and all other issue incident types listed in Attachment A will be addressed by the project activities of the P25 Radio System Roadmap (Attachment B). The roadmap activities are meant to complete the P25 Radio System implementation and identify other activities designed to achieve continuous performance improvements in the system going forward.

Planned Implementation and System Improvements ("P25 Radio System Roadmap")
Completion of the third radio site in addition to the two sites already in operation, and other performance improvement activities planned by DIT will serve to improve overall radio performance. All implementation and improvement activities are listed in Attachment B, the P25 Radio System Roadmap. The following activities are anticipated to have the most significant impact on reducing the incidents of radio issues currently reported by the first responders in Attachment A.

- P25 Portable and Mobile Radio Battery Replacement *[Attachment B, Activity 4]*
  Some of the issues were determined to be caused as a result of poor performance of the radio batteries. New battery replacements for all Fire and Police radios will be completed by February 15, 2012.

- Install Distributed Radio Amplifier/Antenna Systems (DAS) *[Attachment B, Activity 5]*
  DIT will begin the installation of in-building radio antennas in OPD office locations where coverage has been an issue. The antennas will eliminate in-building communications dead zones which cause the radio to go into "CC Scan" mode. In addition to the new batteries, the DAS system installations will be completed by February 15, 2012.

- Move Forward with the Addition of a Third P2S Radio Site *[Attachment B, Activity 7]*
  DIT staff is currently working with Daily and Wells Communications (who installs, tests and maintains the equipment that is manufactured by Harris Corporation) to complete the implementation of the third P25-compliant radio site in addition to the two already in operation. The additional site is scheduled to go into operation the week of February 27, 2012. The addition of the third site will greatly improve radio coverage, eliminating up to 70% of the dead spots.

For information about other planned activities please refer to Attachment B, P25 Radio System Roadmap.

Independent Performance Evaluation

RCC Consultants, Inc., a New Jersey based public safety focused Land Mobile Radio (LMR) engineering and consulting firm, has been retained by the City to conduct an independent evaluation of the City's P25 Radio System. RCC Consultants will issue a report on their findings by March 15, 2012. Below is a listing of their tasks for conducting the independent evaluation:

1. Perform a review and evaluation of the current P25 radio system, which is continuing to evolve, and produce an evaluation report;
2. Develop an interoperability plan to ensure effective communications with our mutual aid partners and connectivity with regional public safety radio networks that are compliant with the national P25 standards; and,
3. Develop an Operations and Maintenance Plan for ongoing support of the P25 radio system.

The work on these efforts began in mid-December 2011 and is presently ongoing. Work accomplished to date includes:

- Analyzed Police and Fire Computer Aided Dispatch (CAD) reports and other relevant reports that provide a chronology of the system's performance since it was launched on June 5, 2011
- Reviewed the inventory of the radio dead spots identified by Police and Fire
- Analyzed and presented the results of the dead spot testing to Police and Fire

- Reviewed the Grand Jury Regional Emergency Communications Report and the responses by the City of Oakland
- Reviewed the P25 radio system contract documentation
- Reviewed Radio Coverage Maps
- Made field trip to all radio sites, Police and Fire Dispatch Centers, and interviewed dispatch supervisors and personnel
- Interviewed Police command staff
- Interviewed Dailey-Wells Communications senior engineers and senior management personnel.

Work underway this past week (week of January 23) included the following activities:

- Continued meetings with Fire Chief and Fire Department supervisors and operational personnel
- Met with Police field operations personnel at "roll-call" meetings at the beginning of each shift
- Met with Executive Director of East Bay Regional Communications System Authority (EBRCSA)
- Interviewed DIT Radio Shop management and technicians

The work being performed by RCC consultants, first and foremost, is to establish an operational baseline of the system as it currentiy exists so that a plan of action can be prescribed to resolve the issues being experienced by our first responders. It is vital that our Police and Fire personnel are able to use the new system with a high degree of confidence.

We believe the actions and plans outiined above will provide significant improvements in the new Public Safety Radio system. Much progress has been made. We look forward to the findings of our independent consultant and will continue to work with our first responders and technicians to improve the performance of the system. I want to continue to thank our public safety employees for their patience and dedication despite experiencing continued implementation issues. We will continue to provide updates to keep the public informed.

Respectfully submitted,

DEANNA J. SANTANA
City Administrator

Attachment A: Daily P25 Radio Problem Incident Report Analysis
Attachment B: City of Oakland—P25 Radio System Roadmap

Attachment A

Daily P25 Radio Problem Incident Report Analysis

ISSUES	2 Sep – 16 Sep	16 Sep – 30 Sep	1 Oct – 15 Oct	16 Oct – 31 Oct	1 Nov – 15 Nov	16 Nov – 30 Nov	1 Dec – 15 Dec	16 Dec – 31 Dec	1 Jan – 15 Jan
Bleed over	2	4	3	4	1	1	0	0	0
CC Scan	99	182	100	155	121	107	92	100	96
Cutting in & out	7	7	8	11	6	5	7	2	11
Dead Spot	8	40	35	10	1	0	2	2	4
Failed Radio	3	12	1	1	1	1	5	3	8
Poor Reception	22	13	14	5	10	7	9	9	8
Poor Transmission	8	8	1	5	7	13	5	12	21
Radio Problems	18	10	4	6	2	5	4	26	3
Unable to Copy Radio	24	22	14	10	20	13	9	14	21
Unable to Receive Transmission	4	4	1	2	6	2	1	5	2
Unable to Transmit	31	34	13	25	5	11	7	15	15
Other	1	0	0	0	0	3	6	4	6
Total Documented	227	336	194	234	180	168	147	192	195

ATTACHMENT B

City of Oakland – P25 Radio System Roadmap

No.	Project Activity	Project Description and Scope	Project Cost ($) & Funding Source	Completion Date
1.	Public Safety Microwave Backbone Upgrade	Design and Build a Microwave Backbone for the implementation of the P25 Digital Radio Public Safety Radio System and related public safety applications. This Backbone will provide redundant communications for the system.	$1.6M US Department of Justice Grant	Completed
2.	Cutover from old Analog Radio System to new P25 Digital Public Safety Radio System	Deploy new P25 Digital Public Safety Radio System at two radio sites	$3.1M Department of Homeland Security Grant	Completed
3.	Coverage Analysis & Dead Spots Testing and Verification	Perform the coverage testing to validate the dead spots identified by OPD, collect and assess the projected improvements made by the installation of a third radio site.	$0	01/31/2012
4.	Replace P25 Radio Batteries	Replace 2600 batteries in Police and Fire radios to improve radio performance and longevity of operation during shifts.	$443K City Funded	02/15/2012
5.	Install new Antenna for improved in-building radio coverage	Install Amplifier / Antenna system at the Police Administration Building and at the Eastmont Mall Police Substation. This new equipment will significantly improve the Radio Coverage inside the two facilities.	$105K Department of Homeland Security	02/15/2012
6.	Cooling and Backup Power System Upgrades at P25 Digital Public Safety Radio System Sites	Upgrade cooling and backup power systems for P25 Digital Public Safety Radio System sites for continuity of operations in case of a power failure or disaster.	$140K Department of Homeland Security	02/17/2012

NO.	PROJECT ACTIVITY	PROJECT DESCRIPTION AND SCOPE	PROJECT COST ($) & FUNDING SOURCE	COMPLETION DATE
7.	P25 Digital Radio System Installation of third radio site.	Expand the P25 Digital Radio Communication System capacity by installing a third radio site.	$1.1M Department of Homeland Security	03/01/2012
8.	Performance Evaluation by Independent Consultants (RCC Consultants)	Measure current system performance against stakeholder expectations and recommend near-term fixes and solutions that build confidence in the new radio system. Develop an interoperability plan to ensure effective communications with our mutual aid partners and connectivity with regional public safety radio networks that are compliant with the national P25 standards. Perform a gap analysis to examine the impact of the new radio system on the City's existing operations procedures and maintenance programs and provide an assessment of potential changes that will be necessary to support the new system	$200K Department of Homeland Security	03/15/2012
9.	Upgrade OFD / OFD Voice Logging for P25 Digital Radio System Radios	Upgrade the Existing Oakland Fire and Police Voice Recording System to o be fully compatible with the new P25 Digital Public Safety Radio System	$253K Department of Homeland Security	03/31/2012
10.	Public Safety Radio Re-Banding Project	The Public Safety Radio Re-Banding is mandated by the FCC to provide clear and interference-free communication channels to the first responders. At the completion of this project, the City will have a reliable, interoperable communication system to ensure the safety of more than 4000 public safety and first responder users.	N/A Sprint/Nextel	06/30/2012
11.	Install Gateway equipment for Regional Interoperability	Install interoperability equipment to connect the Oakland P25 Digital Radio System with BART, the East Bay Regional Communications System Authority (EBRCSA), and other regional partners.	$320K Department of Homeland Security	06/30/2012
12.	Security Enhancement Pilot	OIT will conduct a pilot program to enhance secure public safety radio communications to ensure that police operations are not compromised. The pilot will allow police to determine the effectiveness of the technology and provide the necessary information to seek grant funding for implementation. DIT expects to begin the pilot no later than March 2012.	TBD	TBD

ATTACHMENT F

DISTRIBUTION DATE: 12/13/11
City Administrator's Office

CITY OF OAKLAND

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Deanna J. Santana

SUBJECT: P25 RADIO SYSTEM IMPLEMENTATION UPDATE

DATE: December 12, 2011

INFORMATION

The purpose of this Informadon Memo is to provide an update on the new P25 public safety radio system as reported to me by the Department of Information Technology (DIT). This report provides an updated status since my Information Memo of September 30, 2011 and includes current information regarding system performance, system improvements and planned implementation activities and strategic objectives for moving forward.

System Performance

It has been approximately 190 days since DIT began the deployment of the new public safety P25 radio communications system on June 5. On August 3 and 4, a system software and hardware upgrade was performed to address frequent system failures which affected overall radio system performance. The upgrade improved the reliability of the overall system and provided the much needed stability to allow staff to focus on addressing the issues at the portable and mobile radio user level. As mentioned in the previous reports, we have never experienced any issues with the microwave system and it continues to operate without failure.

The Police and Fire Departments continue to track daily incidents related to portable and mobile radio issues. The data collected shows a trend of progressive improvement in performance. The enclosed table (Table 1—Attachment A) includes the most recent portable and mobile radio incidents reported through November 30.

The most recent two week reporting period for November 16 through November 30 indicates that the numbers of radio problem incidents continue to decrease. Familiarity with the new system by the radio users and the continuation of an aggressive program by DIT to call back and fix problem radios in the field has reduced the number of reported incidents. However, the number of CC Scan issues is still unacceptable and will be addressed by the planned implementation activities outlined later in this update. CC Scan is a condition which alerts the radio user that they have lost communications because they are in an area where there is no radio signal (i.e. a "dead spot"), or the radio signal in the area is too weak for effective communications. A weak or faulty battery can also cause the radio to go into CC Scan mode. This issue is being addressed through system improvements currentiy in progress and the completion of planned implementation activities no later than March 15, 2012.

System Improvements and Planned Implementation Activities

DIT has taken action to improve the effectiveness of the portable and mobile radios in the field by addressing the issue incidents reported in Table 1. Some of the issues were determined to be caused by poor performance of the radio batteries. New replacement batteries that are able to hold a longer charge are now being installed in all radios. The new batteries have reduced the number of daily radio issue incidents and allowed police to work an entire 12 hour shift without the need to recharge their radio batteries. DIT has completed distribution of new batteries to the Fire Department, and distribution to the Police Department is 70% complete.

Further improvements will be accomplished through the following implementation activities which will coihplete the P25 radio system project:

- Move Forward with the Addition of a Third P25 Radio Site – DIT staff are currentiy working with the radio contractor to complete the implementation of the third P25-compliant radio site in addition to the two already in operation. The additional site is scheduled to go into operation no later than February 29, 2012. The addition of the tiurd site will greatiy improve radio coverage, eliminating up to 70% of the dead spots.

- Install Distributed Antenna Systems (DAS) – DIT will begin the installation of in-building radio antennas in OPD office locations where coverage has been an issue. The antennas will eliminate in-building communications dead zones. The installation is scheduled to begin December 14 and will be completed by March 15, 2012. The addition of the in-building antennas will further reduce the issue incidents in Table 1.

Strategic Objcctives for Moving Forward

Moving forward will require that we evaluate what we have accomplished and set a direction for continuous improvements in the new radio system. As an early adopter of P25 technology, we have had many challenges. We continue to work with our vendor and equipment manufacturer to resolve any and all issues as they arise. We have also reached out to local, regional, state and national organizations md public safety agencies that have implemented Harris and Motorola P25 networks. This outreach has provided invaluable technical advice and "lessons learned" for resolving many Issues that they also experienced during their P25 technology implementations. We have developed an ongoing relationship with these early adopters of the P25 technology and have greatiy benefited from their knowledge, experience and neutral opinions.

- Independent Evaluation

  As the City Administrator for the City of Oakland, I made a commitment to have an independent evaluation conducted to ensure that every possible action is taken so that the City's new public safety radio system meets the performance expectations of our first responders. The independent evaluation will address the immediate performance issues

and establish a sound direction for interoperability with our mutual aid partners and long term reliability for the radio system through operational and maintenance best practices. The evaluation by RCC Consultants, Inc. is scheduled to be completed by February 29, 2012. RCC Consultants is a global telecommunications and engineering firm specializing in the testing of Interoperable Radio Systems.

The objectives of the independent evaluation are to:

1. Measure current system performance against stakeholder expectations to ensure that the expectations of the new system are realized
2. Develop an interoperability plan to ensure effective communications with our mutual aid partners and connectivity with regional public safety radio networks that are compliant with the national P25 standards
3. Perform a gap analysis to examine the impact of the new radio system on the City's existing operations procedures and maintenance programs and provide an assessment of potential changes that will be necessary to support the new system

- Security Enhancement Pilot

DIT will conduct a pilot program to enhance secure public safety radio communications to ensure that police operations are not compromised. The pilot will allow police to determine the effectiveness of the technology and provide the necessary information to seek grant fimding for implementation. DIT expects to begin the pilot no later than March 2012.

We believe the actions and plans outiined above will provide significant improvements for moving forward. It is unfortunate that our first responders continue to experience some communication issues, and I closely monitor and seek resolution to these issues; however, overall progress has been made in the area of improved performance of our radio communication system. I want to continue to thank our public safety employees for their patience and steady performance despite experiencing continued implementation issues. We will continue to provide updates to keep the public informed.

Respectfully submitted,

Deanna Santana

DEANNA J. SANTANA
City Administrator

ATTACHMENT A

Table 1: Daily P25 Radio Problem Incident Report Analysis

ISSUES	5 Aug — 19 Aug	19 Aug — 2 Sep	2 Sep — 16 Sep	16 Sep — 30 Sep	1 Oct — 15 Oct	16 Oct — 31 Oct	1 Nov — 15 Nov	16 Nov — 30 Nov
Bleed over	3	2	2	4	3	4	1	1
CC Scan	56	69	99	182	100	155	121	107
Cutting in & out	22	19	7	7	8	11	6	5
Dead Spot	5	4	8	40	35	10	1	0
Failed Radio	26	4	3	12	1	1	1	1
Poor Reception	10	2	22	13	14	5	10	7
Poor Transmission	35	8	8	8	1	5	7	13
Radio Problems	1	8	18	10	4	6	2	5
Unable to Copy Radio	21	46	24	22	14	10	20	13
Unable to Receive Transmission	6	2	4	4	1	2	6	2
Unable to Transmit	25	46	31	34	13	25	5	11
Other	1	8	1	0	0	0	0	3
Total Documented	211	218	227	336	194	234	180	168

ATTACHMENT G

CITY OF OAKLAND

DISTRIBUTION DATE: 8-26-11

MEMORANDUM

TO: HONORABLE MAYOR & CITY COUNCIL

FROM: Deanna J. Santana

SUBJECT: Update P25 Radio System Implementation DATE: August 26, 2011

INFORMATION

Recent reports in the news media provide conflicting conclusions regarding the status of the new P25 radio system. The purpose of this Information Memo is to report on the status of the system implementation and identify remaining issues to be resolved, as reported to me by the Department of Information Technology.

Background

The City of Oakland deployed a new P25 public safety interoperable radio communications system on June 5, 2011. Prior to launching the new system, the City's first responders were equipped with an analog radio system that was nearing 20 years old and was experiencing well-publicized service interruptions and periods of instability.

The new digital P25 system meets approved national standards and ensures interoperability with P25 systems in neighboring jurisdictions in times of emergency or when necessary in the course of daily operations.

The planning, design and implementation of the new P25 system took several years, as is typical for any new technology. Prior to the launch, the Department of Information Technology and the Oakland Police Department conducted an initial 30-day BETA testing during the month of May.

Once the system launched on June 5, the City anticipated a 90- to 120-day post-implementation period which is necessary to stabilize the system and fine tune the hardware and software. Technical issues inevitably arise from the deployment of new technology, especially with a system as complex as the new P25 system. Typically during the implementation period, technicians work with users to resolve any technical issues, conduct user training and make necessary adjustments to the system.

Still, this post-implementation period can be challenging, since we strive to migrate and stabilize 2,000 radio users on this new system without causing any major disruption in day-to-day operations as they become more acclimated to it and we continue to address the remaining issues. We are currently at Day 82 of that 90- to 120-day implementation period.

During this period, public safety personnel have raised issues about challenges they are encountering in the field related to the operation of the radio system. Although the implementation period is understandably frustrating for radio users, safety of first responders and the public are our top priority, and we are working diligently to quickly resolve the reported issues.

Progress Made During Post-Implementation Period

Embedded IT Technical Support in Police and Fire Dispatch to Quickly Address Problems

Since the system launched in early June, technical experts from the vendor team—Harris and Dailey/Wells—have been working 24/7 with our IT staff as well as users and command staff from the Oakland Police Department and Oakland Fire Department to identify and resolve problems as they arise.

Met with Vendor Presidents to Secure High-Level Commitment to Resolving All Issues

During my first week on the job the first week of August, I called a meeting with the presidents of the two vendor companies to ensure that they understood the critical importance of this project and secure their commitment to resolving the issues quickly and thoroughly. During that meeting—and with the Police Chief, the Fire Chief, OPD Command staff, the Interim IT Director and labor representatives present—the company presidents agreed to a two-week term to achieve critical corrective action and improved performance. That two-week window closed on August 19.

During that meeting, the company presidents acknowledged that more than eight weeks after the new system launched, they discovered that they had to correct a critical software problem which was affecting the radios and radio sites; they acknowledged that the system had been launched using an incorrect version of the software which significantly affected radio and system performance.

Identifying and resolving this issue alone consumed the first four to six weeks of implementation. However, this critical time period further eroded first responders' confidence in the radios.

Achieved Improved System Performance Following Software Upgrade

The correct version of the software was installed on August 3 and 4, and performance of the P25 system infrastructure, which consists of the microwave network and radio site equipment, has notably improved.

Daily Tracking of Incidents Indicates Marked Improvement

The Oakland Police Communications Division compiles a daily list of incidents reported by field units. This process of incident tracking has been a long-standing practice to establish trends to assist the technical team in focusing on problem areas that need to be addressed.

Prior to the hardware and software upgrade in early August, officers in the field reported numerous intermittent problems indicating dropped calls, bad/distorted audio, constant beeping sounds and radios going into "signal search" (CC Scan) mode on a constant basis.

During the two-week period following the upgrade—August 5 – 19—reported incidents dropped from 399 to 232, indicating a 42 percent performance improvement compared to the two-week period prior to the upgrade, as shown in the table below.

Table 1: Two-Week P25 Radio System Incident Report Analysis

2-Week Period 22 July - 4 August 2011		2-Week Period 5 August - 19 August 2011	
Cutting in and out	43	Cutting in and out	3
Unable to transmit	64	Unable to transmit	28
Unable to receive transmission	12	Unable to receive transmission	6
Unable to copy radio	57	Unable to copy radio	26
Poor transmission	68	Poor transmission	37
Poor reception	8	Poor reception	11
Intermittent signal	5	Intermittent signal	21
Failed radio	20	Failed radio	31
CCScan	88	CCScan	59
Bleed over	2	Bleed over	2
Beeping	0	Beeping	1
Other	24	Otiier	0
Bad connection	0	Bad connection	1
Reported dead spots	8	Reported dead spots	6
TOTAL INCIDENTS	399		232

Additional Measures Required to Improve Radio Performance

Radio Batteries
The DIT Radio Shop identified that low batteries were a contributing factor to poor radio performance. New portable and mobile radio batteries will be purchased to replace those batteries that have reached the end of their useful life. Reconditioning the existing radio batteries has not produced the expected battery runtimes needed to support a full shift of a field unit.

P25 Radio System Incident Report Analysis
DIT will continue to work with the vendor to evaluate the incident report areas listed above to determine if further adjustments can be made to the system to reduce the number of reported incidents, as well as conduct ongoing training, trouble-shoot identified problems and monitor the performance of the radio system.

Committed to Continuous Performance Improvement

Preventive Maintenance Inspections (PMI)
DIT will conduct a quarterly preventative maintenance inspections on all portable and mobile radios in addition to the *P25* infrastructure to ensure all system components are performing to the manufacturer's specifications.

Stakeholder Feedback Loop
In order to collect regular feedback from the radio users and quickly respond to any problems, weekly and monthly stakeholder meetings take place. The stakeholder team consists of Police, Fire, vendor engineers and DIT radio staff. DIT will continue to monitor the system for an extended period of time to detect any system problem recurrence.

In addition, DIT has taken the following measures to continuously collect feedback about system performance:

- DIT staff and the on-site vendor radio system engineers address issues reported by radio users on a daily basis.
- Implemented additional training programs for the individual user and communications dispatch personnel.
- Conduct regular status briefing sessions for user group command staff.
- Work with OPD at patrol lineups to brief officers on the current status of the radio system and provide radio best practice informational bulletins.
- Continue to work with Oakland Fire Department personnel to develop a custom approach for their specific needs.

Despite any radio disruptions that may arise, priority calls are being addressed, and technical experts from the vendor team—Harris and Dailey/Wells Communications—are working 24/7 to address the remaining issues. DIT will continue to monitor the daily incident reports to ensure the trend of improvement continues.

Independent Consultant

Despite the above-mentioned improvement of the system and the efforts underway by DIT staff and vendor technical experts to improve system performance, there are still issues that must be resolved for the system to be considered fully functional.

I am in the process of obtaining a neutral, third-party to assist the City with obtaining a thorough analysis of the issues and recommend specific measures that will optimize the system's performance. At the appropriate time, I will provide further detail about this effort, but am in exploratory discussions at this point.

My expectation is that by the close of business of the 120-day period (the 1st week of October), we will have addressed the performance problems and, more importantiy, begun to have established confidence in the new system.

In closing, it is important to acknowledge the patience and professionalism of our first responders during this time of transition.

Respectfully submitted,

Deanna Santana

DEANNA J. SANTANA
City Administrator

For questions please contact Ken Gordon, Interim Director, Department of Infonnation Technology, at 238-2023.