August 25, 2010

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street S.W.
Washington, D.C. 20554

Re: Interoperability Showing Supplement for San Francisco Bay Area Urban Area
PS Docket No. 06-229

Dear Ms. Dortch:

In a letter dated August 17, 2010, Jennifer Manner, Deputy Chief of the Public Safety and Homeland Security Bureau, requested additional information to supplement the San Francisco Bay Area Urban Area's "interoperability showing." This letter is respectfully submitted in response to that request.

1. ***It is not clear that Motorola is to be the vendor of every unit of equipment in the network. Please provide more specific information about vendors of the user and network devices and software that will be used in the BayWEB network. In this respect, please identify the vendors and specific products to be used as User Equipment, including the USBDongle, Vehicle Modem, and Smartphone. Please identify the vendors and specific products to be used as eNodeBs. Finally, please identify vendors and specific products for all Enhanced Packet Core (EPC) systems identified in Appendix B of the showing (including Mobility Management Entity (MME), Serving Gateway (SGW), Packet Data Network Gateway (PGW), Home Subscriber Server (HSS), and Policy and Charging Rules Function (PCRF)).***

   Motorola Enterprise Mobility Solutions (EMS) is the provider of the equipment, although it uses several partner vendors. Motorola will also serve as a system integrator and operator for initial phases of the network. As LTE is a nascent technology and the vendor market is evolving, there is a possibility that vendors may merge and/or may be replaced. Nonetheless, the deployment plan includes the following vendors of hardware & software subsystems:

   - eNB – Motorola Networks, WBR700 Series, 700MHz
   - MME – Motorola Networks, WBC700 Series
   - EMS – Motorola Networks, WBM700 Series
   - SGW – Starent-Cisco Systems, WBG700 Series

- PGW – Starent-Cisco Systems, WBG700 Series
- HSS – Bridgewater Systems, EPC500 Series
- PCRF – Bridgewater Systems, EPC500 Series
- Misc. Networking Components – Brocade Networks, Cisco systems.
- Microwave Equipment – Motorola EMS, Aviat.

LTE subscriber devices - The BayWeb architecture will support 3GPP standards based devices, and Bay Area agencies will have the flexibility to procure devices from a number of manufacturers, including Motorola.

2. ***The Bay Area's interoperability showing indicates that roaming capability will not be available in the initial version of the Bay Wireless Enhanced Broadband (BayWEB) network. Section A.2 provides that "[t]he system is capable of supporting roaming with other regional PS LTE systems or with a commercial LTE system with a software upgrade planned for a future release." Sections A.5.3 and A.5.4 say that "an incremental software upgrade" is required for intra-system and inter-system roaming, respectively. Why is roaming capability to be delayed, and for how long? What needs to be accomplished to enable roaming? Is such software upgrade part of the presently contracted system or will it require future contract and expense commitments?***

   The BayWEB network will be constructed with equipment derived from commercial LTE technology. As such, in certain cases, its capabilities will be paced by equivalent capabilities developed for the commercial markets served by this technology. Roaming capabilities require development of the S6a/S8 interfaces as well as multi-band capabilities in the LTE subscriber devices. Roaming support is not yet developed for the commercial markets served by this technology, and thus roaming support will not be available in the initial version of the BayWEB network. Roaming capabilities are planned to be supported in the PLTE Release 3 software version, which is currently targeted for field deployment in 2Q2013. Software upgrades to support roaming are part of the presently contracted system.

3. ***Are the eNodeB and User Equipment (UB) able to operate in frequency bands outside the Band Class (BC) 14 spectrum (758-768 and 788-798 MHz) and PSBB spectrum (763-768 and 793-798 MHz)? If the eNodeB and UB are not able to operate outside of BC14, when will new frequencies of operation be available? Please describe how Inter-System Roaming will be achieved with Verizon Wireless, specifically focusing in the eNodeB and UE initial capabilities and how Inter-System roaming will be added as an "incremental software upgrade."***

The eNB is comprised of band-specific components and band-agnostic components. The band agnostic components can cover any frequency band with appropriate software configuration. The band-specific components are further comprised of multi-band components, such as power amplifiers, and single-band components, such as Tx/Rx filters. The power amplifier can operate in the upper 700MHz bands (ie, BC13 and BC14), covering up to 20MHz FDD channels (ie, 20MHz UL + 20 MHz DL). The single-band Tx/Rx filters are tailored for BC14. Band specific components can be replaced or modified to operate outside of BC14. Support for such capability depends on particular deployment scenarios for the BayWeb Network. Items such as specific carrier partnerships or equipment configurations are still under consideration. Such specific details determine the extent and timeframe for upgrades required to support multiband operation.

As mentioned in response to question 2, the LTE infrastructure (eNB and EPC) will require an incremental software upgrade to support roaming, including inter-system roaming. Initially, the eNB will support broadcasting a single PLMN ID and the EPC will support session management based on a single PLMN ID. An incremental software upgrade will extend these capabilities to support UEs from multiple PLMN IDs; including PLMN IDs from other regional PS LTE networks and commercial carrier networks. The upgrade may also support advertising multiple PLMNs to facilitate roaming across regional PS networks. In order to support Inter-System roaming, the Verizon Wireless network must be interconnected to the public safety networks, minimally via S6a and S8 interfaces. Initially, the EPC will support a single S6a interface within the public safety home system. An incremental software upgrade will extend the EPC capabilities to support additional S6a interfaces to other systems, including Verizon Wireless systems. At the same time, a roaming agreement with Verizon Wireless is required. This is also true between regional PS networks.

Initial UEs will support a single LTE band (ie, BC14). UEs roaming into commercial carrier LTE networks (e.g. Verizon Wireless) must be capable of operating in multiple bands. Multi-band LTE UEs are on Motorola's roadmap. Other vendors may provide multi-band LTE UEs according to their own product plans. Further, coincident with multi-band support, the UE must be able to monitor and switch between bands while in idle mode. The UEs must have appropriate configuration and provisioning of the various roaming lists (eg, preferred roaming list, equivalent PLMN list, and Forbidden PLMN list).

Note: Our interpretation of the Inter-System roaming question is that it pertains to "straight-up" roaming between LTE networks without considerations for inter-PLMN handover. The previous points are in context of this interpretation. However, if the

question intended to include support for inter-PLMN handover, then additional functions and interface impacts would occur in the eNB, EPC, and UE.

4. ***Section C.4, "Reliability and Availability - Radio Access Network", refers to Motorola's R56 "standard". We are not familiar with this "standard". Please provide a copy. Please indicate the relation of R56 to formalized standards documents (industry, federal or other) and to industry standards and practices for installation of commercial mobile systems. Indicate any significant differences between R56 and other major vendor or industry practices. Section C.4 of the showing specifically indicates that the RAN will meet some combination of California Environmental Quality Act (CEQA) and/or R56 standards for "Power Utility service interconnect and backup power sources." Regardless of the source of the requirements, what are the network requirements for backups to commercial power?***

   R-56 "standard" is reference to Motorola's "Standards and Guidelines for Communications Sites," which is comprised of several industry standards such as NFPA, IEEE, TIA/EIA, etc. There are no conflicts between the R-56 standard and any other recognized industry standard; however, in some cases R-56 recommends stricter codes for RF site installations. All BayWeb eNodeB sites will have 8 hour battery backups.

   Motorola's "Standards and Guidelines for Communications Sites" are contained in a voluminous manual that is protected by copyright and is available for commercial purchase. The San Francisco Bay Area Urban Area will provide a copy of this manual subject to a request for confidential treatment because the manual contains commercial information the public disclosure of which would cause harm to Motorola, and thus it falls within Exemption 4 of the Freedom of Information Act ("FOIA"). 5 U.S.C. § 552(b)(4); 47 C.F.R. § 0.457(d).

5. ***Section D.1.4, "RF Engineering - RAN planning - Modeling Assumptions", identifies as an assumption "[a]verage cell edge data rates of 768 Kbps downlink and 200 Kbps uplink." What are the assumed minimum uplink and downlink data rates?***

   The BayWeb network was designed with the goal of minimum data rates of 200 Kbps UL and 768 Kbps DL measured over an agreed upon time interval.

6. ***Do the radio frequency (RF) engineering assumptions and design objectives in the Bay Area's showing apply to both indoor and outdoor areas? if the assumptions and objectives do not apply to all areas, where do they not apply? What power margins are***

assumed for indoor performance and what average and cell edge performance rates are assumed based on these margins?

The current BayWeb network design provides outdoor coverage to mobile data terminals using vehicular modems with external antennae. No indoor coverage has been planned for this initial deployment though we fully expect the BayWeb Network to increase in site density in order to achieve indoor and portable coverage over time.

7. ***Please provide complete, comprehensive and detailed information on the following: RF Link Budget Analysis, Network Capacity and Traffic projections, Coverage Predictions, Network Planning and Model Assumptions.***

Motorola's RF planning process for LTE is based on detailed Monte Carlo simulation rather than a link budget analysis. The dynamic nature of an LTE system makes it impossible to accurately model performance using a static link budget approach. The Monte Carlo simulation does incorporate various link budget related parameters such as output power, line loss, antenna gain, etc. These link-budget related parameters used in the Monte Carlo simulation are summarized below.

Link Budget	**MS-BS**	**BS-MS**	
	UL	**DL**	**Units**
TX 2x40W power	23.0	46.0	dBm
Antenna Gain	-2.8	11.8	dBd
Vehicular loss	0.0	0.0	dB
Building loss	0.0	0.0	dB
CableLoss	0.0	-1.5	dB
Transmit Diversity	0.0	3.0	dB
ERP	**20.2**	**59.3**	dBm
ERP/ENBW	**20.2**	**52.3**	dBm
Antenna Gain	11.8	-2.8	dBd
Cable loss	-1.5	0.0	dB
Building loss	0.0	0.0	dB
Vehicular loss	0.0	0.0	dB
Body Loss	0.0	0.0	dB
Rx Diversity gain	3.0	3.0	dB
Target throughput	200	768	Kbps

The coverage predictions generated from the Monte Carlo simulation using these link budget input parameters can be found in Appendix D. From the network capacity and traffic perspective, the primary parameters used were the target edge data rates of 768 kbps DL and 200 kbps UL for 95% area reliability. The design goal was to identify the area over which the desired reliability is achieved for the specified data rates.

For network planning and modeling, Motorola utilizes an internally developed t ool to design LTE radio networks. The tool considers the following inter-linked criteria when designing LTE systems:

- Coverage
- Interference analysis (inter-sector)
- Capacity and TPUT

The coverage prediction is concerned with estimating the path loss from each eNodeB to all the locations within the coverage area of interest. This is accomplished using industry proven models that Motorola has enhanced over the years to meet specific customer needs taking into account terrain, land cover, antenna directionality, OFDMA and SC-FDMA performance, and a number of additional parameters typical for this class of prediction.

Once this is accomplished, the tool must predict the effects of LTE self-interference onto the probability of achieving a user specified edge throughput given appropriate parameters. To that end Motorola developed a proprietary Monte Carlo Simulation that models the subscriber distribution and behavior based on specific application profiles. Components of the eNodeB and scheduler behavior are modeled to analyze both interference and queuing This includes, but is not limited to:

- Determining how many physical resource blocks can be allocated for each transaction request.
- Queuing and servicing the requests as needed.
- Dynamically allocating resource blocks based on channel quality as well as application data rate.
- LTE specific fractional power control.
- Multiple Input Multiple Output antenna topologies (MIMO).
- Application profiles (required throughput, arrival rate, message size etc.).
- Interference computation across the service area as subscribers are transmitting or receiving data.

The tool's main output is a map outlining the probability of meeting the user's edge throughput across a service area given all the above parameters, along with the number of sectors and their locations.

8. ***We are unable to read the deployment schedule in Appendix B. Please provide a readable copy.***

A readable copy of Appendix B was previously provided to Commission staff.

9. ***The coverage maps in figures 1 to 5 within Appendix D have a single color for covered areas. What performance level is required for an area to be colored purple on the maps? Is the performance level the same for all five coverage maps? Figure 5 depicts coverage that abruptly stops at county borders, specifically the counties adjacent to Sacramento County (where there is no coverage). Please explain why the coverage stops immediately at the county borders, without any additional coverage into adjacent counties. Please provide the Bay Area's proposed plan for interference mitigation and coordination techniques with its region and with this future adjacent region (Sacramento County), which will promote interoperability by minimizing radio frequency interference between them. Are there plans to eventually incorporate adjacent areas (such as Sacramento County) into the BayWEB network?***

   The colored area on the map depicts the same performance level for all five coverage maps. These colored areas represent areas where users can achieve a throughput of 768 Kbps DL and 200 Kbps UL with 95% guaranteed service area reliability.

   Coverage shown in figure 5 of Appendix D stops abruptly at the county boundaries because coverage for the BayWeb Network was modeled within the 10 county Bay Area only. We understand that some coverage beyond the 10 county areas is likely. However, it is our assumption and recommendation that the BayWeb Network EPC serve as the regional EPC for Public Safety LTE network in Northern California rather than an independent LTE network in each county. Therefore, any Public Safety LTE network build-out in adjacent counties and indeed all of Northern California should be coordinated. In addition to interference mitigation techniques available in 3GPP standard, as discussed in our interoperability showing filing, the Bay RICS Policy Group fully intends to incorporate adjacent areas and facilitate such a coordinated network build-out in the Northern California region with all adjacent counties.

10. ***Several publicly viewable interoperability showings that specifically mention Motorola experience, products, and/or support also include a proposal for priority and quality of service treatment. (See, for example, Appendix C of either the Boston or Alabama showing, available at http://fi allfoss.fcc. gov/ecfs/document/view?id=70205497 12 and http://fj allfoss.fcc.gov/ecfs/document/view?id=7020549599 , respectively.) Since the Bay Area is using a Motorola product suite, why is this not included in its showing? Is the priority treatment proposal consistent with ongoing industry work associated with priority requirements for next generation Government Emergency Telephone Service?***

The interoperability showing filing from the San Francisco Bay Area represents the network design, build-out, and interoperability plans for the BayWeb network. Motorola's proposals for priority access and quality of service treatment referred to by the FCC have also been filed in Motorola's response to the FCC's request for comments on Interoperability, Out Of Band Emissions, and Equipment Certification for 700 MHz Public Safety Broadband Networks (PS Docket No. 06-229). While such proposals represent valuable recommendations from Motorola, it is the Bay RICS Policy Group's view that these proposals are more relevant in the realm of the ERIC policy making process and therefore were not included in our interoperability filing. Ultimately, the BayWeb network will be compliant with the priority access framework recommended by ERIC. To our knowledge, Motorola's proposals are consistent with industry work associated with priority requirements for next generation Government Emergency Telephone Service.

11. ***Section C. 1 indicates that a backup Network Operations Center (NOC) will be located at a Motorola site in Schaumburg, IL; but it does not give the location of the primary or regional NOC. Is the Regional NOC a new facility or an existing one, such as an Emergency Management Center? How would this Regional NOC coordinate or interoperate with other networks or NOCs within the state? Will the Motorola NOC support other public safety networks?***

    The primary regional NOC will be a local facility in the San Francisco Bay Area; however, the exact physical location of the NOC has yet to be finalized. We interpret the question to mean coordination with other regional NOCs for LTE public Safety Networks within the State (e.g. Southern California) which is a matter of interest to the Bay RICS Policy Group. We believe such coordination can be planned as other regions within the state firm up their plans for the deployment of regional Public Safety LTE Networks. While Motorola's NOC in Schaumburg currently supports multiple P25 Networks across the country, no discussions have taken place with Motorola in regards to managing multiple LTE networks from their NOC in Schaumburg, IL.

12. ***Will testing involve bench tests, field tests, or both? Are the outlined testing procedures applicable to both?***

    Both bench (aka, lab) tests and field tests will be conducted. Generally, there is some overlap between bench test and field test procedures, but there are significant differences as well. Bench test objectives validate functional and performance aspects with a simulated radio channel model. Contrasting, field tests validate the RF network design using actual RF channels. In addition, the Bay RICS Policy Group also envisions the

use of the 10 site Project Cornerstone network for evaluation of various use cases for Broadband Public Safety Networks. Finally, the testing will also involve coordination and participation in the PSCR testing program in Boulder, CO.

Sincerely,

Executive Director, Bay Area UASI

Cc: Jennifer Manner