

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Requests for Waiver of Various)	PS Docket No. 06-229
Petitioners to Allow the Establishment)	
of 700 MHz Interoperable Public Safety)	
Wireless Broadband Networks)	

ORDER

Adopted: December 10, 2010

Released: December 10, 2010

By the Chief, Public Safety and Homeland Security Bureau:

I. INTRODUCTION

1. In this order, on recommendation of the Emergency Response Interoperability Center (ERIC), we approve an initial set of technical requirements for those public safety jurisdictions (Petitioners) who filed interoperability showings pursuant to the May 12, 2010 order (*Waiver Order*).¹ These Petitioners will be permitted to proceed with deployment of their networks upon certification to the Bureau of their compliance with the technical requirements we impose in this order and those set forth in the *Waiver Order*. Additionally, those Petitioners who declined to file an interoperability showing within the time window specified in the *Waiver Order* will have, as described below, a renewed opportunity to submit a showing and move forward with network deployment.

2. The initial set of technical interoperability requirements we approve herein creates a baseline technical interoperability framework for Petitioners' actual deployment of public safety broadband networks in advance of the Federal Communications Commission's (Commission) adoption of final technical and operational rules for a nationwide interoperable public safety broadband network. As the Commission emphasized in the *Waiver Order*, however, these early-deployed systems must be capable of integration into the interoperable nationwide network that is the subject of the broader rulemaking in this docket. We therefore remind Petitioners that the requirements we impose as conditions of early deployment are subject to, and without prejudice to, the determinations of the Commission's broader rulemaking.² Additionally, we advise Petitioners to proceed with caution in deploying proprietary technologies within their early-deployed networks. Although we recognize that Petitioners

¹ See Requests for Waiver of Various Petitioners to Allow the Establishment of 700 MHz Interoperable Public Safety Wireless Broadband Networks, PS Docket 06-229, *Order*, 25 FCC Rcd 5145 (2010) (*Waiver Order*). This action is taken pursuant to authority delegated to the Bureau in the *Waiver Order*, which granted conditional waivers to twenty-one public safety jurisdictions to pursue early deployment of public safety broadband networks in the 10 megahertz of 700 MHz spectrum (763-768/793-798 MHz) allocated for public safety broadband services. See *Waiver Order* ¶ 56.

² See *id.* at ¶ 62.

must have the flexibility to implement network functionalities that exceed the baseline requirements of this order, such flexibility cannot come at the expense of nationwide interoperability.³

II. BACKGROUND

3. On May 12, 2010, the Commission granted, with conditions, twenty-one waiver petitions filed by public safety entities (Petitioners) seeking early deployment of statewide or local public safety broadband networks in the 700 MHz public safety broadband spectrum (763-768 MHz and 793-798 MHz).⁴ The Commission found that the Petitioners generally met the standard for waiver of the Commission's rules and that the public interest warranted allowing early deployment, provided that Petitioners met certain conditions designed to ensure that their early deployments are "compatible with each other, and with any later actions to establish a nationwide interoperable public safety broadband network."⁵ The *Waiver Order* requires, for instance, that the Petitioners adopt 3GPP standard Release 8 (Long Term Evolution (LTE)) or higher to support roaming by other Petitioners' systems.⁶ The Petitioners must also adhere to certain technical specifications and support a common set of applications.⁷

4. Petitioners were also allowed to submit, within a specified thirty-day window, "interoperability showings" detailing their plans for achieving interoperability with other public safety broadband networks,⁸ and the Bureau was directed to act on these showings within sixty-days of the submission deadline.⁹ Fifteen Petitioners timely filed interoperability showings. On August 17, 2010, the Bureau released an order (*Tolling Order*) tolling its consideration of fourteen of these showings.¹⁰ The Bureau found that these Petitioners' showings did not demonstrate "a defined and certain technical solution" to achieving interoperability, and that there was therefore no "basis for evaluating" their "viability and concreteness."¹¹ The fifteenth showing, that of the San Francisco Bay Area Urban Area

³ We also urge Petitioners to consider in their network deployment and operation the importance of ensuring interoperability with commercial broadband networks and interference mitigation with respect to spectrally adjacent networks.

⁴ See *Waiver Order*.

⁵ *Id.* at ¶ 18. See also Public Safety and Homeland Security Bureau Approves Long Term De Facto Transfer Spectrum Lease Agreements Filed by Conditional Waiver Recipients to Establish 700 MHz Interoperable Public Safety Wireless Broadband Networks, 25 FCC Rcd 12673 (PSHSB 2010) (*Lease Approval PN*). Because the State of Alabama failed to execute a lease agreement with the PSST, it "has failed to meet the Commission's conditions and has no authority to proceed under the *Waiver Order*." *Id.*

⁶ See *id.* at ¶¶ 38, 45.

⁷ See Public Safety Spectrum Trust Ex Parte Filing, PS Docket 06-229 (Dec. 15, 2009) (entering into the docket National Public Safety Telecommunications Council, 700 MHz Public Safety Broadband Task Force Report and Recommendations (2009) (*NPSTC BBTF Report*)). In a public notice, the Bureau sought comment on the PSST's filing and the NPSTC BBTF recommendations. See Comment Sought on NPSTC Broadband Task Force and Public Safety Spectrum Trust Technical Recommendations for 700 MHz Public Safety Broadband Deployments, PS Docket. 06-229, *Public Notice*, DA 10-458 (rel. Mar. 17, 2010) (*NPSTC PN*).

⁸ *Waiver Order* at ¶ 55. Shortly after release of the *Waiver Order*, the Bureau released a public notice offering further guidance to Petitioners in preparing their interoperability showings. See Public Safety and Homeland Security Bureau Offers Further Guidance to Conditional Waiver Recipients on Completing the Interoperability Showing Required by the 700 MHz *Waiver Order*, *Public Notice*, DA 10-923 (rel. May 21, 2010) (*Interoperability Showing Public Notice*).

⁹ *Id.* at ¶ 57.

¹⁰ See Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket 06-229, *Order*, DA 10-1540 (rel. Aug. 17, 2010) (*Tolling Order*).

¹¹ *Id.* at ¶ 7.

(Bay Area), “presented a detailed plan that includes vendor selection and a signed contract.”¹² Nevertheless, the Bureau later tolled its consideration of this showing as well, at the Bay Area’s request.¹³

5. The *Waiver Order* provides that, once the Petitioners have submitted their plans, “ERIC will thereafter recommend for Bureau approval on delegated authority, the initial set of technical requirements that will be applicable to those Petitioners submitting plans.”¹⁴ Once the Bureau approves these requirements, the Petitioners who filed showings may “commence operations upon certification to ERIC that they will meet these technical requirements.”¹⁵

III. DISCUSSION

6. The technical requirements recommended by ERIC for the Bureau’s approval are set forth in Appendix A hereto.¹⁶ We approve each of ERIC’s recommended requirements to the extent indicated below. These requirements will provide an appropriate technical baseline for the early deployment of 700 MHz public safety broadband networks. Those Petitioners who timely filed interoperability showings may, pursuant to the *Waiver Order*, proceed with build-out and operation of their networks upon submission to ERIC of a general certification that their deployments will satisfy each of the requirements we approve herein. Petitioners must also certify their compliance with specific requirements as indicated in various sections below.

7. The technical framework for early deployment specified in this order applies only to those Petitioners who submitted interoperability showings. Those Petitioners who declined to submit interoperability showings within the time window specified in the *Waiver Order* are thus presently ineligible to proceed further with deployment. We find, however, that in light of our approval in this order of more specific technical requirements for deployment, those Petitioners that previously declined to file interoperability showings should be granted a renewed opportunity to develop and submit plans for achieving interoperability. Accordingly, any Petitioner that previously declined to file an interoperability showing may, at its election, file an interoperability showing with the Bureau. Such showing must reflect the requirements of the *Waiver Order*, the guidance set forth in the *Interoperability Showing Public Notice*,¹⁷ and the more specific requirements approved in this order. After the Bureau acts on its showing, a Petitioner may then provide ERIC with its general certification of compliance with the requirements of this order, after which it may proceed with deployment.

8. We find that each of the baseline requirements we establish herein is essential to achieving nationwide interoperability among early-deployed public safety broadband networks. These requirements address core aspects of interoperability, such as roaming capabilities and system identifiers, that are crucial to ensuring that the users of disparate networks are capable of communicating seamlessly. However, seamless interoperable communication is possible only across networks that are fully operable. We are therefore requiring early-deployed networks to meet performance, coverage, and other requirements necessary to ensure that early-deployed networks achieve a baseline of operability sufficient to support interoperable communications. At the same time, we recognize the importance of enabling flexibility for each Petitioner to tailor its deployment to suit its own needs and priorities. The baseline requirements we establish herein will not prevent Petitioners from utilizing customized applications or

¹² *Id.* at ¶ 8.

¹³ See Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket 06-229, Order, DA 10-1755 (rel. Sept. 16, 2010) (*San Francisco Tolling Order*).

¹⁴ *Waiver Order* at ¶ 55.

¹⁵ *Id.*

¹⁶ See *infra* app. A.

¹⁷ See *supra* note 8.

exerting control over traffic prioritization and other aspects of network operations, provided that such activities do not impede interoperability.

A. Public Safety Roaming on Petitioners' Networks

9. Roaming is one of the most basic forms of interoperability, in that it allows “visiting” devices and users to access a local or “host” network for purposes of communicating.¹⁸ In the *Waiver Order*, we required each Petitioner’s system to be capable of supporting roaming by all other Petitioners’ systems and by public safety systems deployed in the future. We continue to require, at ERIC’s recommendation, that technical roaming capability, for both home-routed traffic and local breakout traffic, be available on the date that a Petitioner’s network achieves service availability.¹⁹ The Petitioner must certify its compliance with this condition in the quarterly report that follows its date of service availability.

10. In addition, Petitioners must honor each others’ written requests to support roaming. If parties are unable to reach a roaming agreement within ninety days of the date a request is made in writing, the matter may be referred by either party for Bureau review and action.

B. Technology Platform and System Interfaces

11. Both the technology platform on which public safety applications are supported and the corresponding system interfaces need to be specified in order to ensure full interoperability. In the *Waiver Order*, we required that Petitioners’ systems support those LTE interfaces that are necessary to support the applications and roaming capabilities specified in the order. These required interfaces include:

- Uu- LTE air interface
- S6a – Visited MME to Home HSS
- S8 – Visited SGW to Home PGW
- S9 – Visited PCRF to Home PCRF for dynamic policy arbitration
- S10 – MME to MME support for Category 1 handover support
- X2 – eNodeB to eNodeB²⁰

12. ERIC has since determined that interoperability requires Petitioners to support, in addition to these interfaces, an additional set of interfaces necessary to ensure the interoperability of equipment and devices manufactured by different vendors.²¹ Accordingly, we will require that Petitioners’ systems also support the following interfaces:

- S1-u – between eNodeB and SGW
- S1-MME – between eNodeB and MME
- S5 – between SGW and PGW
- S6a – between MME and HSS

¹⁸ For purposes of this order, roaming occurs when a mobile station receiving service from a station or system in a network other than one to which it is a subscriber.

¹⁹ For purposes of this order, “service availability” is achieved when the system is being used on a day-to-day basis for operational functions by at least fifty users.

²⁰ *Waiver Order* at ¶ 47.

²¹ See Alcatel-Lucent Ex Parte Filing, PS Docket 06-229 at 3 (filed Aug. 18, 2010) (“Public Safety Broadband Interoperability Recommendations: FCC Interoperability Vendor Meeting”).

- S11 – between MME and SGW
- SGi – between PGW and external PDN
- Gx – between PGW and PCRF (for QoS policy, filter policy and charging rules)
- Rx – between PCRF and AF located in a PDN
- Gy/Gz – offline/online charging interfaces

13. We also recognize that LTE currently allows the use of both IP version 4 (IPv4) and version 6 (IPv6). ERIC has recommended that, as it continues to examine this issue, the Bureau should permit the use of either or both versions in early-deployed public safety broadband networks. We approve this recommendation.

C. System Identifiers

14. Compliance with 3GPP standards requires that public safety broadband networks be assigned network identification numbers.²² In a public notice (*Technical Public Notice*) seeking comment on technical aspects of interoperability, the Bureau sought comment on two alternatives identified in the *NPSTC BBTF Report*²³ for assigning network identification numbers to regional networks: (1) assignment of a single Public Land Mobile Network identifier (PLMN ID) to the nationwide public safety network, or (2) assignment of a different PLMN ID to each regional network.²⁴ We also noted the *NPSTC BBTF Report* conclusion that, because of the limited availability of network identification numbers, only one-hundred or fewer such numbers should be assigned.²⁵ We sought comment on whether this proposed limitation could hamper implementation of the second approach.²⁶

15. In comments responding to the *Technical Public Notice*, Alcatel-Lucent, the District of Columbia, and Motorola endorsed a third approach, a hybrid scheme in which a separate PLMN ID would be assigned to each regional network and another PLMN ID would be assigned to the nationwide network.²⁷ The Public Safety Communications Research Program (PSCR) has also expressed support for this proposed hybrid scheme in discussions with Bureau staff.²⁸ AT&T, on the other hand, supported the first approach, the adoption of a single PLMN ID for the nationwide public safety broadband network,²⁹ while IP Wireless raised concerns about this approach.³⁰

16. ERIC, based on its technical analysis, has determined that the scheme adopted for PLMN IDs will play an important role in shaping the architecture of the nationwide public safety broadband

²² See, e.g., 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Network Sharing; Architecture and functional description (Release 9), 3GPP TS 23.251 at 4.2.1 (2009).

²³ See *supra* note 7.

²⁴ See Public Safety and Homeland Security Bureau Seeks Comment on Interoperability, Out of Band Emissions and Equipment Certification for 700 MHz Public Safety Broadband Networks, PS Docket 06-229, *Public Notice*, 25 FCC Rcd 5486 (PSHSB 2010) (*Technical Public Notice*).

²⁵ See *id.* at 5487; see also NPSTC BBTF Report at 6.3.1.

²⁶ See *Technical Public Notice* at 5487-88.

²⁷ See Alcatel-Lucent Comments on *Technical Public Notice* at 7-8 (filed July 19, 2010); District of Columbia Comments on *Technical Public Notice* at 7 (filed July 16, 2010); Motorola Comments on *Technical Public Notice* at 19 (filed July 19, 2010).

²⁸ See Public Safety Communications Research Program Slide Presentation at 25-26 (July 21, 2010).

²⁹ See AT&T Comments on *Technical Public Notice* at 11 (filed July 19, 2010).

³⁰ See IP Wireless Comments on *Technical Public Notice* at 3 (filed July 20, 2010) (stating that adoption of a single nationwide PLMN ID could “result in a single national core network and favor commercial operators, reducing options and flexibility of waiver system operators, and potentially delay deployments under waivers”).

network and in facilitating nationwide interoperability. We therefore adopt ERIC's recommendation to defer consideration of a comprehensive scheme for PLMN IDs until this matter is addressed in the broader rulemaking in this docket. However, we recognize the importance of establishing an interim mechanism for the assignment of PLMN IDs to early-deployed networks. We will therefore require each Petitioner to submit, at least ninety days prior to its date of service availability, notice to the Bureau of its need for a PLMN ID for its network. This notice may be submitted as part of a quarterly report. After receiving this notice, the Bureau will, based on ERIC's recommendations, work with the Petitioner to determine an appropriate course for obtaining a PLMN ID for its network.

D. Conformance Testing

17. Interoperability requires that user devices and network equipment comply with relevant standards specifications.³¹ ERIC recommends that conformance testing, a process generally planned and developed by industry organizations and conducted at certified laboratories, be implemented to ensure that devices and equipment that Petitioners deploy in the public safety broadband spectrum are compliant with Release 8 (LTE) and higher of 3GPP standards.

18. While ordinarily it would be appropriate to require conformance testing in advance of network deployment, ERIC notes that a conformance testing and certification process for user devices operating in LTE Band Class 14—which includes the public safety broadband spectrum—is not yet available. The PCS-Type Certification Review Board (PTCRB),³² however, is expected soon to complete development of such a process. At ERIC's recommendation, we require that, within six months of either (1) the Commission or Bureau's release of a public notice announcing the availability of the PTCRB testing process for Band 14, or (2) the Petitioner's date of service availability—whichever date is later—each Petitioner must certify to the Commission that it has completed this process in consultation with a certified laboratory. In this certification, each network operator must also commit to any future testing called for within the certification process. Petitioners may submit these certifications as part of their quarterly reports.

E. Interoperability Testing

19. Interoperability testing (IOT) is an important mechanism for ensuring that public safety broadband networks are technically capable of supporting roaming, a central component of interoperability. ERIC recommends that the Bureau require Petitioners to perform IOT for the LTE interfaces necessary to support roaming. These include:

- U_u – LTE air interface
- S6a – Visited MME to Home HSS
- S8 – Visited SGW to Home PGW
- S9 – Visited PCRF to Home PCRF for dynamic policy arbitration

20. We recognize that IOT is still evolving with respect to the LTE standard, and we accordingly find that it would be premature to specify an IOT protocol in this order. However, given the vital role IOT plays with respect to interoperability, we require, at ERIC's recommendation, that each Petitioner submit, in the quarterly report following its date of service availability, a plan for conducting IOT on the interfaces specified above. The scope of testing outlined in the plan must be sufficiently broad to address all of the capabilities and functions required by the *Waiver Order*. Additionally, the plan should commit to testing on a regular basis with other Petitioners' networks that have achieved service

³¹ See *NPSTC BBTf Report* at 6.1.5 (recommending establishment of “a LTE equipment and features test facility” for “the features in LTE that support the roaming and interoperability requirements” recommended in the report).

³² PTCRB “is a global organization created by Mobile Network Operators to provide an independent evaluation process where GSM / UMTS Type Certification can take place.” See PTCRB, <http://www.ptcrb.com>.

availability. Further, we encourage all Petitioners to work together on the development of these plans, to ensure that interoperability is achieved among networks. As ERIC recommends, Petitioners should address their ongoing progress with IOT in their quarterly reports to the Bureau. In the future, the Bureau will take action to delineate further testing requirements to advance the goal of interoperability among early-deployed networks. We anticipate that this action will occur in the next few months.

F. Operation of Permanent Fixed Stations

21. ERIC notes that the 700 MHz public safety mobile broadband spectrum has excellent propagation characteristics for mobile wireless broadband services, but cautions that allowing wide-spread fixed use of mobile spectrum could complicate the interference environment of early-deployed networks and adversely impact operability and interoperability by potentially limiting network access at crucial times or in emergency situations.³³ Accordingly, at ERIC's recommendation, and in order to preserve mobile interoperability, we will require that Petitioners' systems in the 700 MHz public safety broadband spectrum be permitted to use permanent fixed point-to-point and point-to-multipoint stations only on an ancillary basis. All such ancillary operations will be permitted only on a secondary, non-interference basis to the primary mobile operations.

G. Performance

22. The Radio Access Network provides wireless communications between user devices and network operator antennas. Radio network planning and baseline operability requirements are perhaps the most important elements of the network design process, due to the proximity of these network elements to mobile users. If public safety networks cannot meet baseline operability requirements or achieve high spectral efficiency, the ensuing lack of operability will prevent systems from successfully interoperating. As ERIC notes, achieving high spectral efficiency and coverage will enable the delivery of broadband services, and promote the availability and interoperability of commonly supported applications, to the largest possible number of users given the available spectrum resources. Accordingly, we approve ERIC's recommendation that we require Petitioners' systems to provide outdoor coverage at minimum data rates³⁴ of 256 Kbps uplink (UL) and 768 Kbps downlink (DL), for all types of devices, for a single user at the cell edge. Petitioners' systems must provide the minimum data rates, based on a sector loading of seventy percent, throughout the entire network.³⁵ Each Petitioner must certify its compliance with these requirements in the quarterly report that follows its date of service availability. This certification must be based on a representation of the actual "as-built" network and accompanied by UL and DL data rate plots that map specific performance levels, to include 256 Kbps UL and 768 Kbps DL.

H. Coverage

23. In order to facilitate interoperable communications throughout the geographic areas for which Petitioners have sought waivers for early deployment, ERIC has recommended that we specify coverage requirements for early-deployed networks. We adopt ERIC's recommendation that we require each operator of an early-deployed network to submit, for ERIC's review, a plan for achieving significant population coverage within its jurisdiction within ten years of its date of service availability. Although we do not precisely define "significant population coverage," we clarify, at ERIC's recommendation, that this standard is more robust than "substantial service," a coverage standard applicable under Commission

³³ See, e.g., P.J. Marshall et al., *The feasibility of spectrum sharing between DS-CDMA mobile radio systems and microwave point-to-point links*, IEEE 46th Vehicular Technology Conference (1996).

³⁴ The data rate in this context is measured and defined at the physical layer and is the provided rate with less than or equal to a ten percent block error rate. Also, a 5+5 MHz LTE system typically uses twenty percent overhead on the DL and about twelve percent overhead on the UL.

³⁵ Seventy-percent loading per sector indicates that seventy percent of the air interface resources in each sector are serving traffic to devices.

rules to certain types of wireless communications services.³⁶ We anticipate that, for any early-deployed network, a plan to achieve “significant population coverage” would likely include plans to cover all major population centers within the Petitioner’s jurisdiction, as well as major highways and thoroughfares; airports, bus terminals, rail stations and other transportation hubs; convention centers, sports arenas, and other venues that attract large crowds; areas susceptible to hurricanes, floods or other natural disasters; and strategic locations identified as vulnerable to terrorist attack. In addition, we would expect that such planning would cover more rural areas as appropriate for a particular Petitioner’s geography. A Petitioner’s plan may be submitted as part of the quarterly report that follows its date of service availability.

I. Coverage Reliability

24. While geographic coverage of a network is important to ensure a baseline of nationwide interoperability, ERIC notes that coverage reliability is another critical factor. An unreliable network is inoperable, and therefore not interoperable. Areas of poor performance and inadequate coverage must be identified as well as assessed, to ensure that a sufficient level of operability and interoperability is maintained throughout the network coverage area. Accordingly, at ERIC’s recommendation, we will require that Petitioners’ systems provide a probability of coverage of 95 percent for all services and applications throughout the network as built.³⁷ This requirement finds support in several of Petitioners’ interoperability showings,³⁸ and is a standard commonly used today by the Land Mobile Radio and Cellular industries.

J. Security and Encryption

25. The *Waiver Order* requires, as recommended in the *NPSTC BBTF Report*,³⁹ that Petitioners’ systems support the optional security features specified in 3GPP TS 33.401. At ERIC’s recommendation, we clarify that both aspects of these security features, namely “integrity protection and verification of data” and “cipherng/decipherng of data,” must be supported for signaling. The requirements will more adequately ensure the security of the network, hence further advancing interoperability.

³⁶ See, e.g., 47 C.F.R. § 90.685(b) (defining “substantial service” for a particular service as “[s]ervice which is sound, favorable, and substantially above a level of mediocre service”). Moreover, although we do not specify a numerical coverage requirement for Petitioners’ early deployments, we note that a 99-percent population coverage model was used in developing the National Broadband Plan and associated cost modeling. See FED. COMMUNICATIONS COMM’N, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN at 318 (2010); see also FED. COMMUNICATIONS COMM’N, OMNIBUS BROADBAND INITIATIVE, A BROADBAND NETWORK COST MODEL: A BASIS FOR PUBLIC FUNDING ESSENTIAL TO BRINGING NATIONWIDE INTEROPERABLE COMMUNICATIONS TO OUR NATION’S FIRST RESPONDERS at 2 (2010).

³⁷ For systems that provide mobile radio coverage achieving at least 95-percent reliability throughout the service area, the following definition is given. If the Reliability of signal strength is given in percentage within the coverage area predicted as an example, signal reliability is the measured minus predicted values or shaded areas within the typical coverage maps that are predicted to have 95-percent coverage reliability. This means that if the entire area is divided uniformly into 100 locations then 95 of these locations will provide satisfactory coverage and 5 of these locations may provide unsatisfactory coverage. In an actual verification of satisfactory coverage performance the test must be based on a large number of locations consistent with good statistical practice.

³⁸ Twelve Petitioners’ showings expressed support for a 95% coverage reliability requirement. See, e.g., Adams County, Colorado, Interoperability Showing at 20 (filed July 19, 2010); State of Alabama Interoperability Showing at 22 (filed July 19, 2010); City of Boston Interoperability Showing at 23 (filed July 19, 2010); City of Charlotte Interoperability Showing at 25 (filed July 19, 2010); State of Mississippi Interoperability Showing at 24 (filed July 19, 2010); City of San Antonio Interoperability Showing at 17 (filed July 19, 2010); City of Pembroke Pines Interoperability Showing at 21 (filed July 19, 2010).

³⁹ See *NPSTC BBTF Report* at 6.3.3.

K. Interference Mitigation

26. The *Waiver Order* imposes coordination requirements on Petitioners whose jurisdictions border one another.⁴⁰ ERIC recommends that we further require that Petitioners employ interference mitigation techniques that will avoid signal or spectral efficiency degradation within a region and between overlapping or adjacent regions. Specifically, ERIC recommends that we require each Petitioner to implement the Static Inter-Cell Interference Coordination feature among its eNodeBs by its date of service availability to ensure that the network operates without interference. We approve this recommendation, as it will ensure that interference is limited, thereby advancing interoperability.

IV. PROCEDURAL MATTERS

27. *Paperwork Reduction Act of 1995*. This document contains new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to comment on the new or modified information collection requirements contained in this proceeding.

V. ORDERING CLAUSES

36. Accordingly, IT IS ORDERED that pursuant to sections 1, 4(i), 301, 303, 332 and 337 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 301, 303, 332 and 337, and the *Waiver Order*, 25 FCC Rcd 5145 (2010), THIS ORDER in PS Docket No. 06-229 is ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

James Arden Barnett, Jr., Rear Admiral (Ret.)
Chief, Public Safety and Homeland Security Bureau

⁴⁰ *Waiver Order* at ¶¶ 41-42.

APPENDIX A

Letter From Jennifer A. Manner, Acting Director, Emergency Response Interoperability Center and Deputy Bureau Chief, Public Safety and Homeland Security Bureau, to James Arden Barnett, Jr., Chief, Public Safety and Homeland Security Bureau, Recommending an Initial Set of Technical Requirements for Network Deployment by 700 MHz Public Safety Broadband Waiver Recipients That Filed Interoperability Showings



Federal Communications Commission
Washington D.C., 20554

November 22, 2010

James Arden Barnett, Jr., Rear Admiral (Ret.)
Chief, Public Safety and Homeland Security Bureau
Federal Communications Commission

Re: ERIC Recommendations for Waiver Recipients in the 700 MHz Public Safety Broadband Spectrum

Dear Admiral Barnett:

Pursuant to the *700 MHz Waiver Order*,⁴¹ the Emergency Response Interoperability Center (ERIC) hereby submits for the approval of the Public Safety and Homeland Security Bureau (Bureau) its recommendations for an initial set of technical requirements to be applied to the early-deployed 700 MHz public safety broadband networks of waiver recipients (Petitioners) that filed interoperability showings with the Bureau. These recommendations are based on a review of the fifteen interoperability showings filed by the Petitioners and the record in FCC Docket No. 06-229. By adopting the initial set of technical interoperability requirements ERIC recommends herein, the Bureau will create a baseline technical framework for Petitioners' actual deployment of interoperable public safety broadband networks in advance of the Federal Communications Commission's (Commission) adoption of final technical and operational rules for the nationwide network.

Recommended Requirements

A. Public Safety Roaming on Petitioners' Networks

ERIC recommends clarifying that technical roaming capability, for both home-routed traffic and local breakout traffic, must be available on the date that a Petitioner's network achieves service availability.⁴² A Petitioner who achieves service availability should be required to certify its compliance with this condition in the following quarterly report.

ERIC recommends that Petitioners be required to honor each others' written requests to support roaming. If parties are unable to reach a roaming agreement within ninety days of the date a request is made, either party should have the option of referring the matter for Bureau review and action.

⁴¹ See Requests for Waiver of Various Petitioners to Allow the Establishment of 700 MHz Interoperable Public Safety Wireless Broadband Networks, PS Docket 06-229, *Order*, 25 FCC Rcd 5145, 5164 ¶ 55 (2010) (*700 MHz Waiver Order*).

⁴² For purposes of these recommendations, "service availability" is achieved when the system is being used on a day-to-day basis for operational functions by at least fifty users.

B. Technology Platform and System Interfaces

ERIC recommends that, in addition to the interfaces required in the *700 MHz Waiver Order*, Petitioners' systems should also be required to support a range of interfaces necessary to ensure the interoperability of equipment and devices manufactured by different vendors.⁴³ Specifically, the Bureau should require that Petitioners' systems support the following interfaces:

- S1-u – between eNodeB and SGW
- S1-MME – between eNodeB and MME
- S5 – between SGW and PGW
- S6a – between MME and HSS
- S11 – between MME and SGW
- SGi – between PGW and external PDN
- Gx – between PGW and PCRF (for QoS policy, filter policy and charging rules)
- Rx – between PCRF and AF located in a PDN
- Gy/Gz – offline/online charging interfaces

ERIC also recommends that, as we continue to examine the transition from IP version 4 (IPv4) to IP version 6 (IPv6), Petitioners should be permitted to use both versions in their early-deployed networks.

C. System Identifiers

Compliance with 3GPP standards requires that public safety broadband networks be assigned Public Land Mobile Network (PLMN) identification (ID) numbers.⁴⁴ However, consideration of a nationwide scheme for obtaining and assigning PLMN ID numbers would be premature in advance of final rulemaking. We therefore recommend adoption of an interim scheme for Petitioners' early-deployed networks. ERIC recommends that the Bureau require each Petitioner to submit, at least ninety days prior to its date of service availability, notice to the Bureau of its need for a PLMN ID. ERIC would then work with that Petitioner to determine an appropriate course for obtaining a PLMN ID.

D. Conformance Testing

ERIC recommends that conformance testing, a process generally planned and developed by industry organizations and conducted at certified laboratories, be implemented for Petitioners' early-deployed networks to ensure that devices and equipment deployed in the public safety broadband spectrum comply with Release 8 (LTE) and higher of 3GPP standards.

ERIC recognizes that a formal conformance testing process for LTE Band 14—which includes the public safety broadband spectrum—is not available. We note, however, that the PCS-Type Certification Review Board is expected soon to complete development of such a process. ERIC recommends that, within six months of either (1) the Commission or Bureau's release of a public notice announcing the availability of the PTCRB testing process for Band 14, or (2) the Petitioner's date of service availability—whichever date is later—each Petitioner should be required to certify to

⁴³ See Alcatel-Lucent Ex Parte Filing, PS Docket 06-229 at 3 (filed Aug. 18, 2010) (“Public Safety Broadband Interoperability Recommendations: FCC Interoperability Vendor Meeting”).

⁴⁴ See, e.g., 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Network Sharing; Architecture and functional description (Release 9), 3GPP TS 23.251 at 4.2.1 (2009).

the Commission that it has completed this process in consultation with a certified laboratory. In this certification, each network operator should also be required to commit to any future testing called for within the certification process.

E. Interoperability Testing

Interoperability testing (IOT) is an important mechanism for ensuring that public safety broadband networks are technically capable of supporting roaming, a central component of interoperability. ERIC recommends that the Bureau require Petitioners to perform IOT for the LTE interfaces necessary to support roaming. These include:

- U_u – LTE air interface
- S6a – Visited MME to Home HSS
- S8 – Visited SGW to Home PGW
- S9 – Visited PCRF to Home PCRF for dynamic policy arbitration

In the quarterly report following its date of service availability, each Petitioner should be required to submit a plan for conducting IOT on the interfaces specified above for Bureau approval. The scope of testing outlined in the plan should be sufficiently broad to address all of the capabilities and functions required by the *Waiver Order*. Additionally, the plan should commit to testing on a regular basis with other Petitioners' networks that have achieved service availability. ERIC recommends that the Petitioners update the Bureau on their progress with IOT in their quarterly reporting. Further, ERIC recommends that the Bureau consider issuing, in the near future, a public notice delineating further testing requirements to advance the goal of interoperability.

F. Operation of Fixed Stations

The 700 MHz public safety broadband spectrum has excellent propagation characteristics for mobile wireless broadband services. However, the wide-spread use of this spectrum for fixed operations could complicate the interference environment of an early-deployed network, and adversely impact its operability and interoperability, by potentially limiting network access for mobile users at crucial times or in emergency situations. ERIC therefore recommends that operation of fixed stations in early-deployed networks be permitted only on a secondary, non-interference basis to mobile operations.

G. Performance

Early-deployed systems must satisfy baseline operability requirements in order to successfully interoperate with other networks. For instance, high spectral efficiency and network performance will enable the delivery of broadband services, including access to the common set of applications required in the *700 MHz Waiver Order*, to the largest possible number of users given the available spectrum resources. We therefore recommend that ERIC require Petitioners' systems to meet baseline performance requirements, namely that they provide outdoor coverage at minimum data rates⁴⁵ of 256 Kbps uplink (UL) and 768 Kbps downlink (DL), for all types of devices, for a user at the cell edge. Petitioners' systems should provide the minimum data rates, based on a sector loading of seventy percent, throughout the entire network.⁴⁶ Each Petitioner should be required to certify its compliance with these requirements in the quarterly report that follows its date of service availability.

⁴⁵ The data rate in this context is measured and defined at the physical layer and is the provided rate with less than or equal to a ten percent block error rate. Also, a 5+5 MHz LTE system typically uses twenty percent overhead on the DL and about twelve percent overhead on the UL.

⁴⁶ Seventy-percent loading per sector indicates that the sector is loaded to this level of traffic.

This certification should be based on a representation of the actual “as-built” network and accompanied by UL and DL data rate plots that map specific performance levels, to include 256 Kbps UL and 768 Kbps DL.

H. Coverage

As an important step in promoting the Commission’s long-standing goal of widespread coverage for public safety broadband networks, the Bureau should require Petitioners to provide a plan for achieving significant population coverage⁴⁷ within their jurisdictions within ten years of their date of service availability.

I. Coverage Reliability

Network availability is a critical factor in ensuring that early-deployed networks are both operable and interoperable during emergency situations. ERIC therefore recommends that the Bureau require Petitioners’ systems provide a probability of coverage of 95 percent for all services and applications throughout the network. We note that this requirement finds support in several of Petitioners’ interoperability showings,⁴⁸ and it is a standard commonly used today by the Land Mobile Radio and Cellular industries.

J. Security and Encryption

The *Waiver Order* requires, as recommended in the *NPSTC BBTF Report*,⁴⁹ that Petitioners’ systems support the optional security features specified in 3GPP TS 33.401. ERIC recommends that the Bureau clarify that both aspects of these security features, namely “integrity protection and verification of data” and “cipherring/decipherring of data”, must be supported for signaling.

⁴⁷ This standard should be considered more robust than “substantial service”, a coverage standard applicable under Commission rules to certain types of wireless communications services. *See, e.g.*, 47 C.F.R. § 90.685(b) (defining “substantial service” for a particular service as “[s]ervice which is sound, favorable, and substantially above a level of mediocre service.”). We note that a 99-percent population coverage model was used in developing the National Broadband Plan and associated cost modeling. *See*, FED. COMMUNICATIONS COMM’N, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN at 318 (2010); *see also* FED. COMMUNICATIONS COMM’N, OMNIBUS BROADBAND INITIATIVE, A BROADBAND NETWORK COST MODEL: A BASIS FOR PUBLIC FUNDING ESSENTIAL TO BRINGING NATIONWIDE INTEROPERABLE COMMUNICATIONS TO OUR NATION’S FIRST RESPONDERS at 2 (2010).

⁴⁸ *See, e.g.*, Adams County, Colorado, Interoperability Showing at 20 (filed July 19, 2010); State of Alabama Interoperability Showing at 22 (filed July 19, 2010); City of Boston Interoperability Showing at 23 (filed July 19, 2010); City of Charlotte Interoperability Showing at 25 (filed July 19, 2010); State of Mississippi Interoperability Showing at 24 (filed July 19, 2010); City of San Antonio Interoperability Showing at 17 (filed July 19, 2010); City of Pembroke Pines Interoperability Showing at 21 (filed July 19, 2010).

⁴⁹ *See NPSTC BBTF Report* at 6.3.3.

K. Interference Mitigation

In addition to the coordination requirements set forth in the *700 MHz Waiver Order*, ERIC recommends that the Bureau require Petitioners to employ interference mitigation techniques that will avoid signal/spectral efficiency degradation within a region and between overlapping or adjacent regions. Specifically, the Bureau should require each Petitioner to implement the Static Inter-Cell Interference Coordination feature among its eNodeBs by its date of service availability to ensure that its network operates without interference.

Sincerely,

Jennifer A. Manner
Acting Director, Emergency Response Interoperability Center
And Deputy Bureau Chief
Public Safety and Homeland Security Bureau