Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the matter of	)	
	)	
Service Rules for the 698-746, 747-762 and 777-792 MHz Bands	)	WT Docket No. 06-150
	)	
	)	
Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band	)	PS Docket No. 06-229
	)	
	)	
Amendment of Part 90 of the Commission's Rules	)	WP Docket No. 07-100

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EXECUTIVE SUMMARY

Definition of "Interoperability." When the Commission adopts a definition of "interoperability," it should clarify two related matters adopted in the *Third Report and Order*: first, it should clarify that backward compatibility to Release 8 only applies to features and functions that are necessary for interoperability. It should also clarify that optional Release 8 interfaces that are solely internal to a network need not be supported.

Architectural Framework. Ericsson submits that the 3GPP Standardization Organization is the appropriate entity to oversee and keep current the architectural framework for the LTE-based public safety network.

Architectural Guiding Principles. The *Notice* would require regional and Tribal networks to support a national framework for quality of service and priority access, which is not an objective, standards-based characteristic and appears to be an open-ended and undefined support requirement with no indication of how this will be overseen or what its objectives must be. In addition, the establishment of a common clearing house for roaming is not a standards-based network architectural feature. One unmentioned guiding principle that should be supported is encouragement of shared network infrastructure — between public safety and commercial, as well as regional and Tribal networks.

Open Standards. The Commission should continue to support technologies that employ open standards. There are risks associated with proprietary technologies — access to such technologies can be limited or costly, and they can become unavailable.

Technology Platform and System Interfaces. There are many enhancements in Release 9 and Release 10 that provide enhancements for real-time communications, emergency services, location services. Backward compatibility exists and will continue to exist for basic functionalities — handsets from the 1990s still work on networks using later software releases, and can roam across networks using different releases. Backward compatibility is the standard for each 3GPP release. For example, LTE Advanced will include Carrier Aggregation, allowing multiple blocks of spectrum to be used together for Release 10 devices, while maintaining compatibility with Release 8 devices by using individual blocks of spectrum to support them.

With regard to use of IPv4 and IPv6, Ericsson notes that they can coexist in the same network; there is no need to mandate the use of IPv6 either from the start or from some particular date. Ericsson also notes that Proxy Mobile IPv6 ("PMIP") and the corresponding Gxc interface are not essential, and their support should not be required.

Roaming Configurations. The most appropriate roaming mode depends on the kinds of services being provided. For public safety networks deployed independently as part of one nationwide interoperable network, affording both home-routed and local-breakout roaming may improve needed access to services.

Roaming Authentication and Internetworking Functions. There are generally efficiency gains if roamer authentications are performed by third party clearing houses, but the decision to use a clearing house, and which one to use, should be a decision of the network operator.

Prioritization and Quality of Service. LTE supports the interplay of both prioritization of particular connections and QoS treatment of traffic on such connections by taking account of both the priority of the user and the nature of the application. The current Release 8 QoS scheme is sufficient to support the needed functionality.

Mobility and Handover. Both types of handover (X2 and S1) can be used simultaneously. Selecting one or the other depends on requirements of a particular network's architecture, and the better handover will depend on the application.

Performance. Ericsson believes that system performance requirements such as data rates and sector loading should not be inflexibly mandated. Overly stringent requirements may require deployment of large amounts of equipment, increasing deployment costs and thereby delaying buildout and putting rural coverage at risk.

Coverage Requirements. The Commission should refrain from imposing inflexible coverage requirements that may put an overdue burden on public safety; any rules should allow for flexibility in meeting regional requirements.

Interference Coordination. Ericsson recommends that neither Static or Semi-Static Inter-Cell Interference Coordination be mandated.

Public Safety Roaming on Public Safety Broadband Networks. The proposed definition of three types of roamers appears to be a distinction without a difference, given that the Commission has tentatively concluded all three types should be accommodated on all 700 MHz broadband public safety networks.

Interoperability Testing. Public safety networks should adopt the same terminal certification and testing procedures as the commercial LTE community. The public safety community and the FCC should not "reinvent the wheel." Adding special testing for public safety will increase costs and delay availability of equipment. In any event, optional interfaces should not be mandated.

Network Operations, Administration, and Maintenance. Establishment of a mandated national management structure will delay deployment and jeopardize the flexible approach of employing regional networks. Flexibility is the best way to achieve a national network.

Devices. It is unclear that the lower bandwidths of 1.4 and 3 MHz will be needed, but there is a need for devices with 5 and 10 MHz channel bandwidths. Requiring additional bandwidth options may increase the cost of equipment through testing and stocking variants that may not be in demand on the commercial side.

Operation of Fixed Stations. Ericsson supports allowing public safety to operate fixed services in the public safety broadband spectrum on an ancillary basis.

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To: The Commission

COMMENTS

Ericsson Inc hereby submits its Comments in response to the Commission's *Third Report and Order and Fourth Further Notice of Proposed Rulemaking*[1] concerning the implementation of interoperable public safety broadband networks at 700 MHz.

I. INTRODUCTION

The Commission has adopted rules and proposed further rules to create an effective technical framework for ensuring the deployment and operation of a nationwide interoperable public safety broadband network. Ericsson congratulates the FCC for taking the initiative to provide a workable framework for this interoperable network — one that includes the policies and rules that are necessary to ensure interoperability, but without increasing the cost of operation and deployment by specifying additional unnecessary features and functions.

Adopting a common air interface based on LTE advances the objective of a nationwide interoperable public safety wireless broadband network. In these Comments, Ericsson provides

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[1] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, WT Docket 06-150 *et al.*, *Third Report and Order and Fourth Notice of Proposed Rulemaking*, 26 F.C.C.R. 733 (2011) (*Notice*), *summarized*, 76 Fed. Reg. 10295 (Feb. 24, 2011).

its input on the technical rules for the public safety broadband network from an LTE standards perspective.

II. COMMENTS ON SPECIFIC ISSUES

A. TECHNICAL RULES FOR THE PUBLIC SAFETY BROADBAND NETWORK

1. DEFINITION OF INTEROPERABILITY (¶ 16)

The Commission seeks comment on how "interoperability" should be defined. Ericsson believes that a proper definition requires refinement or clarification of two matters discussed in the *Third Report and Order* section of the document:

Paragraph 11 currently requires backward compatibility for all subsequent releases to Release 8 "in order to ensure the baseline for interoperability is preserved."[2] In defining interoperability, the Commission should clarify those specific features and functions that must be retained from one release to the next. Absent clarification, paragraph 11 (and Rule Section 90.1407(d)) would appear to require backward compatibility to Release 8 even as to aspects of the standard that are not necessary for interoperability. Backward compatibility is intended to preserve the baseline for interoperability, which should not include features and functions that are not part of that baseline because they are not necessary for interoperability. The Commission should clarify through the definition of interoperability the components of subsequent Releases that must be backward compatible to Release 8. It is important not to be overinclusive in this regard, because future Releases may modify existing components in a non-backward-compatible fashion to improve their functionality, although such changes are rare.[3]

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[2] 26 F.C.C.R. at 738.

[3] *See also* discussion of backward compatibility at page 8 below.

As a related matter, paragraph 12 (and corresponding Rule Section 90.1407(e)) includes a comprehensive list of Release 8 interfaces that must be supported.[4] Not all of these interfaces, however, require support for interoperability. In particular, interfaces that are solely internal to a given network should not be subject to a support requirement. Standardized interface support should be applicable only to non-optional intersystem interfaces, and, furthermore, only to those that are well tested and validated in commercial deployments. Two examples of interfaces for which mandatory support may not be necessary at this time are:[5]

- The "S5 – between SGW and PGW" interface.[6] This interface is optional for some deployments, as shown in Section 4.2.1 of TS23.401.[7] If a given network is deployed without reliance on this internal interface, using the single gateway configuration option, there should be no need to support it.
- The Gy interface included in "Gy/Gz – offline/online charging interfaces"[8] pertains to prepaid service and does not appear to be an interface necessary to mandate for interoperability. However, if it is nevertheless mandated, it will need validation for security and authentication before it can be supported. To the best of Ericsson's knowledge, it has never been tested and validated in commercial LTE service.

In defining interoperability, the Commission should ensure that it is not being overinclusive as to the interfaces that must be supported, because providing interface support is expensive, adds complexity, and may delay deployment.

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4 28 F.C.C.R. at 738.

5 These are also mentioned at page 16 below with respect to interoperability testing.

6 *Id.* at 738, 775 (§ 90.1407(e)).

7 3rd Generation Partnership Project, "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access, 3GPP TS 23.401 V8.13.0, § 4.2.1, Fig. 4.2.1-2 Note 1 (Mar. 2011), *available at* http://www.3gpp.org/ftp/Specs/2011-03/Rel-8/23_series/23401-8d0.zip.

8 28 F.C.C.R. at 738, 775 (§ 90.1407(e)).

2. ARCHITECTURAL FRAMEWORK (¶ 17)

The *Notice* proposes "a set of high-level principles to guide development of the network in a manner that ensures interoperability" and asks, among other things:

> Are there entities other than the Commission that are better situated to establish an architectural framework for the network and keep the framework current? If so, who are these other entities and how would they achieve this?[9]

The development of the architecture for LTE is defined within the 3rd Generation Partnership Project ("3GPP") through contributions by its membership. Accordingly, 3GPP is an appropriate entity to take a leading role regarding the architectural framework for the LTE-based interoperable public safety broadband network. How the 3GPP organization is utilized in this respect should be defined by entities such as operators, and in the case of public safety, the FCC or its delegate. Therefore, public safety should establish a formal representation in 3GPP. The Public Safety Spectrum Trust ("PSST"), which is the public safety broadband licensee, could join 3GPP as NIST has, but at this time PSST does not formally represent U.S. public safety organizations in 3GPP. Ericsson would support a formal US public safety representative within the 3GPP Standardization Organization ("SDO").

3. ARCHITECTURAL GUIDING PRINCIPLES (¶¶ 18–26)

In setting out the guiding principles for the interoperable network's architecture, the *Notice* lists the common characteristics that the Commission believes regional and Tribal networks need to support and maintain. Among these is "Support of a nationwide framework for Quality of Service and Priority Access."[10] This is not an objective, standards-based network characteristic; instead it appears to impose an open-ended and undefined support requirement on

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[9] 26 F.C.C.R. at 740 [¶ 17].

[10] *Id.* at 741 [¶ 19].

the regional and Tribal system operators. There is no indication what entity or body the FCC envisions defining the nationwide framework for Quality of Service and Priority Access, what procedures will be employed to define it, or the objectives the framework must be aimed at fulfilling. Nor does the *Notice* tentatively propose how many such frameworks there may (or must) be — must all regional and Tribal operators support a single nationwide framework, or can there be multiple nationwide frameworks to address different objectives or user groups?

Concerning roaming, the *Notice* observed that the National Public Safety Telecommunications Council ("NPSTC")'s Broadband Task Force Report "recommends the establishment of a common clearing house for the purpose of roaming."[11] Clearing house functionality is not a standards-based network architectural feature. It is not defined in the 3GPP standards, for example, although clearing houses are commonly used to support roaming, based on GSM Association ("GSMA") rules, specifications, and guidelines regarding billing and data exchange. A clearing house is an agent that is used to exchange information about GSM roaming calls and roaming agreements between operators. In an LTE-based nationwide public safety network, third-party clearing houses would likewise be expected to carry out these functions to facilitate roaming.

The *Notice* also included an open-ended call for comments on network architectural principles:

> We seek comment on whether we should establish guiding principles for public safety broadband network architecture and, if so, whether the principles summarized above are the principles that should serve as the basis for this vision. Are there are other principles we should consider? For example, should shared infrastructure also be encouraged through such a vision in order to reduce costs of network deployment?[12]

[11] 26 F.C.C.R. at 741 [¶ 21].

[12] 26 F.C.C.R. at 742 [¶ 25].

One important guiding principle should be to encourage sharing of network infrastructure, which has been included in LTE since its inception — between commercial and public safety networks, as well as among regional and Tribal networks. Shared network infrastructure can create opportunities to speed up deployment, to achieve wider geographic coverage, to reduce roll-out costs and investments, and to lower the cost of operation. As a practical matter, shared networks can increase the coverage and addressable market or reduce the time to market for new services by existing or new networks.

4. OPEN STANDARDS (¶¶ 27-28)

Ericsson agrees that the Commission should "take additional measures to encourage public safety broadband network operators to adopt technologies that employ open standards."[13] As the Commission has already recognized, open standards have considerable benefits.[14] They attract investment, encourage innovation, and deliver economies of scale that can quickly drive prices of devices and infrastructure down, enabling more feature-rich services for a given amount of investment. By definition, open standards can support interoperability between manufacturers as well as between device and infrastructure providers. Moreover, functionality related to policy control, Quality of Service ("QoS"), and charging mechanisms benefit greatly from open standards.

The *Notice* also asks about "the potential dangers to interoperability associated with the use of devices and equipment that employ proprietary technologies."[15] In Ericsson's view, the main danger of proprietary technology is that features, functions, processes, access, and interoperability are controlled by the proprietor of that technology. As a result, access to the

[13] 26 F.C.C.R. at 743 [¶ 28].

[14] *Id.* at 742-43 [¶ 27].

[15] *Id.* at 743 [¶ 28].

technology and its usage is dependent upon the business interests of the holder. Access to the technology can be limited or costly, and it can be affected by whether the technology holder is able to remain in business and maintains a business model open to fair and reasonable licensing of the technology. A change in ownership or business model can upset expectations regarding the proprietary technology's availability and, in some cases can adversely affect its continued use and potentially cause a disruption in service. Proprietary technologies carry with them the potential for higher equipment cost, as well.

5. TECHNOLOGY PLATFORM AND SYSTEM INTERFACES (¶¶ 29–31)

The *Notice* "seeks comments on the features of Release 9 and Release 10 that are necessary for applications such as real-time voice/video communications, location-based services, multicasting/broadcasting voice/video services, and other emergency preparedness related services."[16] Ericsson is an active participant in the development of those releases and notes that Release 9[17] and beyond do provide enhancements for real-time communications such as voice through enhancements to the specifications in the area of positioning for requirements such as E911 as well as emergency services. Release 9 additionally adds support for IMS emergency calls (section 7.2 of the Release 9 description) as well as location services (called LCS in section 8 of the Release 9 description) for packet sessions that would allow expedited delivery of emergency sessions as well as positioning of devices requesting those services. The full list of features per release can be found on the 3GPP site.[18]

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16 26 F.C.C.R. at 743 [¶ 29].

17 http://www.3gpp.org/ftp/Information/WORK_PLAN/Description_Releases/Rel-09_description_20110401.zip.

18 http://www.3gpp.org/ftp/Information/WORK_PLAN/Description_Releases/.

The *Notice* asks whether interoperability could be maintained if the Commission permitted the "use of multiple 3GPP releases within different networks."[19] The simple answer is that a basic set of functionalities is maintained across Releases, including functionality such as mobility and bearer maintenance. The main focus for backward compatibility should concentrate on roaming and the Uu interface, which is kept backwards compatible. The current state of backward compatibility can be illustrated noting that GSM phones from the 90s can be, and indeed are, used on existing networks. Handsets meeting GSM specifications do not become obsolete when the network on which they are used upgrades to a new release; they continue working as before. Similarly, roaming can work across multiple Releases. Specifically, interoperability will be maintained across different Releases, except as to those rare feature changes that do not maintain backward compatibility. If maintaining these same service functionalities across Releases is deemed critical for interoperability, the need for backward compatibility issue will have to be addressed during standards revisions and developments and should not be a matter for regulatory concern. If certain specific features or functions are deemed critical for interoperability, and they are revised in a subsequent Release in a non-backward-compatible manner, all networks will need to be updated when the new Release is put in place.

The *Notice* also seeks comment "on the future evolution of the LTE technology platform and how it will support forward and backward compatibility and interoperability with Release 8."[20] In other words, the Commission asks what new LTE Releases are planned, what features and applications of those releases will be appropriate and applicable to the public safety network,

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[19] 26 F.C.C.R. at 743 [¶ 29].

[20] *Id.*

whether LTE Advanced or other LTE revisions will be backward compatible to LTE Release 8, and whether adoption of such Releases and capabilities should be required. As discussed in the preceding paragraph, backward compatibility is the standard for each 3GPP Release, with only rare deviations. LTE Advanced will support enhanced data rates to support advanced services and applications.[21] LTE Advanced will also include Carrier Aggregation for a prescribed set of bands, which will allow carrier transmissions in separate bands of spectrum (contiguous or non-contiguous) to be effectively combined, either symmetrically or asymmetrically, for Release 10 devices, while the carriers in the separate bands remain fully compatible with Release 8 devices that are not capable of Carrier Aggregation.[22]

The *Notice* inquires whether the use of both IPv4 and IPv6 "in various components of the nationwide network create obstacles to achieving interoperability, either now or in the future?"[23] This will not create obstacles to interoperability, because IPv4 and IPv6 can coexist in the same network. It would be an inappropriate constraint on network design and evolution for the Commission to mandate or prohibit the use of a particular IP version. Likewise, in response to the Commission's inquiry regarding migration to IPv6 or use of it at the start,[24] Ericsson reiterates that IPv4 and IPv6 can coexist in the same network. It is not, and should not be, a requirement that IPv6 be used. Given the eventual migration to IPv6, it would be advisable for new networks to utilize IPv6 from the initial deployment, but manufacturers and network

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[21] The schedule of releases and basic feature sets can be found 3GPP site http://www.3gpp.org/releases.

[22] *See* Mai-Anh Phan, Ericsson Radio Protocols and Multimedia Technologies Research, *Carrier Aggregation Concepts for LTE Rel-10* (2010), *available at* http://www.3g4g.co.uk/LteA/LteA_CA_1005_Ericsson.pdf.

[23] 26 F.C.C.R. at 744 [¶ 30].

[24] *Id.*

designers are well aware of this. There is no need to mandate the use of IPv6 at any particular date.

The *Notice* also asks whether the Commission should require public safety broadband networks to support Proxy Mobile IPv6 ("PMIP") and the Gxc interface used in conjunction with PMIP.[25] While LTE networks can connect to non-LTE networks via the PMIP standard and the Gxc interface, this is not an essential feature of LTE. PMIP and Gxc support should not be required, because those features and corresponding architecture are not necessary for an LTE network.

6. ROAMING CONFIGURATIONS (¶¶ 35–36)

The *Notice* asks whether all broadband networks should be required to have the ability to support both home-routed and local-breakout roaming, and tentatively finds that they should.[26] The most appropriate roaming mode depends on the kinds of services that will be provided. Some services benefit from these features whereas other services may not. In the case of public safety networks that are deployed somewhat independently but nevertheless as part of one nationwide interoperable network, roaming over large distances on the nationwide network is to be expected, and affording both roaming modes may improve needed access to services. For example, local-breakout roaming may improve the ability of roaming first responders to access emergency networks attached to the host system in the interest of interoperability, while home-routed roaming may be equally beneficial in providing the roaming first responder to have ready access to databases and applications that are commonly used.

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[25] *Id.* [¶ 31].

[26] *Id.* at 745 [¶ 35] (Home-routed roaming allows the roamer to access the resources of its home network, while local-breakout roaming provides access to the resources of the host network.).

7. ROAMING AUTHENTICATION AND INTERWORKING FUNCTIONS (¶ 37)

Ericsson generally agrees that there would be "significant efficiency gains if roamer authentications were performed by third party clearing houses rather than by each network operator."[27] The benefits of using clearing houses are related to economies of scale, just as equipment purchases are. However, the decision to use a clearing house, and which one to use, is not solely an economic decision; this should be a decision of the network operator, who also must take into account considerations such as security, privacy, and reliability.

8. PRIORITIZATION AND QUALITY OF SERVICE (¶¶ 43–46)

As the Commission notes, prioritization relates to the connection with the network (and, more specifically, the network's assignment of priority to particular connections), while QoS relates to the treatment of traffic after a connection is established (and, more specifically, the network's assignment of appropriate performance attributes to different applications).[28] With this understanding, the *Notice* asks how networks should support both prioritization and QoS as well as the applications using the connections,[29] given that there may be conflicts in how assets are deployed when both priority access and QoS come into play,[30] especially since LTE provides fifteen levels of user connection priority and nine QoS priority levels.[31] LTE handles such situations by taking account of both the priority of the user (*e.g.*, public safety) and the nature of

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[27] 26 F.C.C.R. at 745 [¶ 37].

[28] *Id.* at 746 [¶ 43].

[29] *Id.*

[30] The Commission notes that a high priority user receives priority with respect to obtaining a connection, but "that priority may not hold if the application types are different. For example, a priority scheme may choose not to give a connection priority to a higher priority user with video application rather than to a lower priority user with voice application." *Id.* at 747 [¶ 45].

[31] *Id.* [¶ 46].

the application. For example, lower retention priority bearers (*i.e.*, connections associated with lower-priority users) are shed to accommodate higher bandwidth demands from preferential users. Among users with the same preference bandwidth adjustments may happen to accommodate these users.

In response to the questions in paragraph 46 of the *Notice* concerning the adequacy of the QoS and Priority Access features in Release 8,[32] Ericsson believes the current Release 8 QoS scheme is sufficient to support the required functionality.

9. MOBILITY AND HANDOVER (¶¶ 47–50)

The *Notice* asks about the two methods of handover:

> LTE supports two methods of handover, one is through direct links between source eNodeB and target eNodeB, called X2 based handover, and the other one through indirect links between eNodeBs through the core, called S1 based handover. . . . What are [the] advantages and disadvantages of each one?[33]

Ericsson notes that both X2 and S1 handovers can be used simultaneously. X2 handovers have the advantage of not losing data buffered in the eNodeB (through direct forwarding) while performing the handover as well as reducing the handover latency. X2 handovers also mandate S1 relocation, both S1-MME and S1-U.[34] Selecting one or the other depends on requirements on network architecture:

- X2-HO is between eNodeBs and always without change of MME, and it requires X2 connectivity between the eNodeBs.

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[32] *Id.* ("Which features specific to QOS and Priority Access in the December 2009 freeze of 3GPP LTE Release 8 are currently being developed for implementation in LTE equipment? Are these adequate to support a solid framework for public safety needs relating to priority access and interoperability? Are they all to be used for such framework or should the FCC look at different approaches?").

[33] 26 F.C.C.R. at 747 [¶ 48].

[34] *See generally* 3GPP TS 23.401 at §§ 5.5.1.1, 5.5.1.2.

- S1-HO involves more core network signaling and allows change of MME.
- S1-HO therefore, for example, allows change of operator and change of 3GPP access.

The better handover method will depend on the application. Absolute real-time X2 handovers have the advantage of less disruption, but pure S1 relocations also work for most scenarios. Regarding the selected solution's effect on interoperability in the context of handovers between two neighboring networks,[35] Ericsson notes that it is not envisioned that X2 will be used between different networks. X2 is not a multi-vendor interface in practice today and it therefore should not be considered necessary for interoperability. Instead the focus should be on S1, and X2 should be left to each region to implement..

10. PERFORMANCE (¶¶ 59–62)

The Commission tentatively concluded in the *Notice* that it should require outdoor minimum data rates for a single user at cell-edge of 256 Kb/s up and 768 Kb/s down, and that as a matter of initial design these minimum rates should be provided based on 70 percent sector loading throughout the network.[36] Ericsson believes that system performance requirements such as these should not be inflexibly mandated through a rule or Commission policy, but should be discussed at the time of negotiations. Some of these requirements are very stringent and may not reflect a dynamic traffic load that requires an increase in the UL data rate and, as a result, may require deployment of a large amount of equipment for each site and sector to ensure compliance. This will force budget-constrained network operators to rein in their deployment plans to minimize costs, delaying buildout and potentially putting rural coverage at risk. System

[35] 26 F.C.C.R. at 747 [¶ 48].

[36] 26 F.C.C.R. at 751 [¶ 61].

operational specifications such as bandwidth allocation and sector loading levels should be left to the system designer, rather than being established through rulemaking.

11. COVERAGE REQUIREMENTS (¶¶ 71–73)

The Commission has tentatively decided to impose coverage requirements as well as the performance requirements discussed above, because "[c]overage is an important consideration in ensuring that the public safety broadband network is interoperable on a nationwide basis."[37] Coverage is always an important consideration in designing a network. Rather than impose inflexible *ex ante* coverage requirements by rule, the Commission should leave this issue to be negotiated. The FCC should refrain from adopting stringent requirements as that may put an overdue cost burden on public safety, and any rules the Commission does adopt should allow for flexibility in meeting regional requirements. Moreover, coverage may be defined in several different ways — it can simply be defined on the basis of geographical area, it can be defined as population, or it can take both area and population into account. Like performance, coverage should not be subject to inflexible mandates, but should be determined based on service needs.

12. INTERFERENCE COORDINATION (¶¶ 76–79)

The *Notice* asks whether the Commission should require Static or Semi-Static Inter-Cell Interference Coordination ("ICIC") for interference mitigation, or whether there are other features that would be better for interference coordination and mitigation.[38] Ericsson recommends that the ICIC feature not be mandated. This feature is advantageous in certain deployment scenarios and increases cell-edge performance, but it may be unnecessary, given the

[37] *Id.* at 754 [¶ 71].

[38] 26 F.C.C.R. at 756 [¶ 78].

level of utilization expected in a public safety network and the performance requirements already tentatively proposed in paragraph 61 of the *Notice*.

B. PUBLIC SAFETY ROAMING ON PUBLIC SAFETY BROADBAND NETWORKS

The *Notice* proposes to adopt standardized nomenclature defining three types of roamers — itinerant roamers, interoperability roamers, and response roamers — and asks whether this would "facilitate technical and operational aspects of the roaming."[39] It is unclear why the Commission proposes to define these three types of roamers, given that it has tentatively concluded that all three types of roamers should be accommodated on all 700 MHz broadband public safety networks,[40] and it does not appear to have proposed any distinctions among the three for purposes of its proposed roaming policies. If the Commission adopts the three definitions, it should explain why it is creating such distinctions without any difference in treatment.

C. TESTING AND VERIFICATION TO ENSURE INTEROPERABILITY

1. INTEROPERABILITY TESTING (¶¶ 109–115)

Regarding the Commission's proposed interoperability testing regime for public safety broadband network equipment.[41] Ericsson submits that public safety networks should adopt the same terminal certification and testing procedures as the commercial LTE community, with Band class 14 included in the normal process used for other spectrum bands, and not be required to re-do testing or certifications already completed in that framework. The public safety LTE network is a part of the worldwide LTE environment. As such, public safety terminal equipment

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[39] 26 F.C.C.R. at 758 [¶ 87].

[40] 26 F.C.C.R. at 759 [¶ 88].

[41] 26 F.C.C.R. at 763-65 [¶¶ 109-15].

should comply with LTE standards in order to ensure operability between terminal equipment and the network.

The public safety community and the Commission should not "reinvent the wheel" when it comes to interoperability development testing and multi-vendor terminal verification; industry procedures already ensure that these processes occur in normal commercial practice. Adding some type of special testing for public safety will have no effect on testing and verification, but will increase costs that ultimately are reflected in the price of terminal equipment, and delay the availability of that equipment. The more network interfaces that have to be certified through interoperability testing, the more expensive it would get and the longer time it would take. PS should leverage commercial deployments and not mandate interoperability testing of network interfaces.

One of the interfaces the Commission proposes to subject to interoperability testing is the Uu – LTE Air Interface.[42] Ericsson's view is that Uu is important for interoperability. Moreover, optional interfaces should not be mandated, but should be included or not only upon the definition of the architecture for a specific deployment. Specifically, we note that the *Notice* proposes to require interoperability testing for the S5 and Gy interfaces. As discussed above, these bands are not considered necessary for interoperability and should be excluded from the definition of interoperability.[43]

[42] *Id.* at 763 [¶ 110].

[43] *See* page 3 above.

D. OTHER MATTERS RELEVANT TO INTEROPERABILITY ON PUBLIC SAFETY BROADBAND NETWORKS

1. NETWORK OPERATIONS, ADMINISTRATION AND MAINTENANCE (¶ 117)

Early decisions regarding the operation of the broadband public safety networks involving network management, administration/provisioning, and maintenance would facilitate a quick resolution as there may be significant rework (and potentially recall of SIM cards) with associated cost for any early deployments. Establishment of any mandated national management structure would likely further delay deployment of waiver networks, and could possibly eliminate the faster and more flexible approach of employing regional networks. The networks can later be connected and "roaming" agreements set-up among them. Even within networks 3GPP LTE has features that facilitate deployment of cells. Such a feature is called SON (Self Organizing Networks). In short, even though the ultimate objective is a mandate for a national network, flexibility is the best approach to achieving that objective. Any mandates could also potentially make it more difficult to establish network management arrangements such as network operations outsourcing that could be adopted by the waiver requesters. Such arrangements are becoming more common in the commercial networks and could also benefit the public safety network operators as well.

2. DEVICES (¶¶ 119–22)

The *Notice* sought comment on a number of interrelated device bandwidth issues:

> We seek comments whether public safety LTE devices should be required to support 1.4/3 MHz channel bandwidth in the public safety broadband spectrum. What would be the advantage/disadvantage of having multiple channel bandwidth support for public safety, such as 1.4/3/5/10 MHz Bandwidth channels? What are the costs for such an approach and do the benefits support the addition of any cost? What would be the potential impacts to device certification and national interoperability? Would there be any operational impacts to the public safety broadband network if 1.4/3

> MHz channels were supported by devices but not used? What would be the impact on costs?[44]

Ericsson notes that the LTE standards support the lower bandwidths of 1.4 and 3 MHz, but it is unclear that all supported channel bandwidths would be necessary for operation. At this point, Ericsson sees a need for devices with channel bandwidths of 5 and 10 MHz. Requiring additional bandwidth options may increase the cost of equipment due not only to increased complexity, but also to the increased cost to test the equipment and to stock multi-bandwidth variants that may not be in demand on the commercial side of the market. Moreover, lower bandwidths are less spectrally efficient than the wider bandwidths if the spectrum is divided into multiple channels/carrier bandwidths.

It is unclear why the Commission sees a need to address this issue. If it is attempting to provide for a contingency such as division of the public safety broadband spectrum among different operators within the same coverage area, that is probably not a sufficiently likely scenario on which to base an expensive additional requirement.

3. OPERATION OF FIXED STATIONS AND COMPLEMENTARY USE OF FIXED BROADBAND SPECTRUM (¶¶ 129–31)

Ericsson supports the use of the band to allow public safety to operate fixed services in this band on an ancillary basis. Fixed services could actually make things easier on the network as capacity and throughput increase naturally. It also reduces the capacity needs on the mobility nodes as the signaling load goes down with stationary devices, due to a much more limited need for handovers.

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[44] 26 F.C.C.R. at 766 [¶ 120].

III. CONCLUSION

Accordingly, Ericsson urges the Commission to incorporate the foregoing points into its public safety broadband rules.

Respectfully submitted,

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