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EXECUTIVE SUMMARY

Harris Corporation sets forth the following recommendations and endorsements in response to the Commission's *Public Notice*: (1) Harris believes that the National Public Safety Telecommunications Council ("NPSTC") Broadband Task Force Report, which Harris participated in developing, provides a good starting point for the work of the Emergency Response Interoperability Center ("ERIC") when developing final technical rules for the nationwide public safety broadband network; (2) Harris recommends the "Interoperability Showing" framework established for waiver licensees be expanded and required for all future licensees; (3) ERIC should develop a framework of minimum requirements with input from organizations such as NPSTC; (4) Harris recommends a Network-of-Network National Architecture comprised of multiple Core Networks each serving as an aggregation point for Regional Networks within its footprint and providing redundancy for adjacent regions; and (5) in the event the D-Block is auctioned, Harris recommends that equipment operated within the D-Block and Public Safety Broadband Blocks comply with symmetric (*i.e.*, identical) emissions and receiver performance requirements in order to quantify expected levels of interference between these two networks.

In addition, Harris reiterates its support of the Commission's efforts to establish a nationwide interoperable public safety broadband network (hereinafter "NPSBN") based on Long Term Evolution ("LTE") technology and is encouraged by the Commission's proposal in the National Broadband Plan to provide a source of federal funding for the deployment of the network. Furthermore, Harris is pleased with the Commission's simultaneous action that provides public safety the ability to take advantage of a crucial broadband communications resource today, while still working with public safety to plan for the broadband communications

networks of tomorrow. Harris believes that even while the final NPSBN rules take shape, the Commission should continue to accept and expeditiously evaluate waivers for initial deployment in the 700 MHz public safety broadband by local, state, and regional public safety entities as they are submitted.

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band)	PS Docket No. 06-229
)	
)	

To: The Commission

COMMENTS OF HARRIS CORPORATION

This filing is submitted on behalf of Harris Corporation (“Harris”) before the Federal Communications Commission (“Commission”) in response to the Commission’s *Public Notice*¹ seeking comment on the interoperability, out of band emissions (“OOBE”), and equipment certification for 700 MHz public safety broadband networks. When developing these technical requirements Harris recommends the Commission do so under a Network-of-Network national architecture approach comprised of multiple Core Networks each serving as an aggregation point for Regional Networks within its footprint and as a redundant core for neighboring regions. Harris’ comments on interoperability, OOBE, and equipment certification for the 700 MHz public safety broadband networks will address each category of questions presented by the Commission in the format of the Commission’s *Public Notice*.

¹ Public Safety and Homeland Security Bureau Seeks Comment on Interoperability, Out of Band Emissions, and Equipment Certification for 700 MHz Public Safety Broadband Networks, *Public Notice*, DA 10-884 (rel. May. 18, 2010), *modified*, Public Safety and Homeland Security Bureau Seeks Comment on Interoperability, Out of Band Emissions, and Equipment Certification for 700 MHz Public Safety Broadband Networks Comment Date Extended, *Public Notice*, DA 10-1070 (rel. June 14, 2010).

Harris reiterates its support of the Commission’s efforts to establish a nationwide interoperable public safety broadband network (hereinafter “NPSBN”) based on Long Term Evolution (“LTE”) technology and is encouraged by the Commission’s proposal in the National Broadband Plan² to provide a source of federal funding for the deployment of the network.³ Harris applauds the Commission’s action that has simultaneously provided jurisdictions the opportunity to conduct initial deployments in the 700 MHz public safety broadband spectrum,⁴ while working to establish final rules for the NPSBN in a timely fashion—such as through the establishment of the Emergency Reliability and Interoperability Center (“ERIC”).⁵ Harris encourages the Commission to continue to allow public safety entities to take advantage of the public safety broadband spectrum by expeditiously granting waivers to encourage network build-out through waiver and facilitating thoughtful planning for future nationwide network integration through ERIC.

Harris is an international communications and information technology company serving government and commercial markets in more than 150 countries. Harris is a leading technology developer and manufacturer of mission-critical wireless communications for the public safety communications market with more than 500 critical communications systems deployed worldwide. As a pioneer in the development of IP based networks for private radio and broadband

² Report to Congress, A National Broadband Plan for Our Future, Federal Communications Commission, pp. 317-319 (Mar. 16, 2009).

³ Comments of Harris Corporation, Comment Sought On NPSTC Broadband Task Force and Public Safety Spectrum Trust Technical Recommendations for 700 MHz Public Safety Broadband Deployments, PS Docket No. 06-229, p. 3 (filed Apr. 6, 2010) (“Harris Technical Comments”) (supporting the use of LTE and the establishment of a funding mechanism for the deployment of a nationwide public safety broadband network).

⁴ Requests for Waiver of Various Petitioners to Allow the Establishment of 700 MHz Interoperable Public Safety Wireless Broadband Networks, Order, PS Docket 06-229, 25 FCC Rcd. 5145 (rel. May 12, 2010) (granting twenty-one waivers for early deployment in the 700 MHz public safety spectrum and expecting the Public Safety and Homeland Security Bureau to be able to act quickly on future waiver requests for early deployment).

⁵ In the Matter of Establishment of an Emergency Response Interoperability Center, Order, PS Docket No. 06-229 and GN Docket No. 09-51, 25 FCC Rcd. 5145 (rel. Apr. 23, 2010).

applications, Harris supplies industry-leading brands such as VIDA Broadband™, EDACS®, OpenSky®, NetworkFirst™, P25^{IP} (Project 25), and Provoice™. In addition, Harris now offers first responders full-spectrum multiband products for joint public safety operations on the local, state, and federal levels: the Harris Unity™ XG-100 and RF-1033M. Harris is also an active member of numerous standards and technical committees including the TR-8 Mobile and Personal Private Radio Committee of the Telecommunications Industry Association.

I. INTEROPERABILITY

A. Applications

Harris participated in the National Public Safety Telecommunications Council's ("NPSTC") Broadband Task Force ("BBTF") and in the development of the final BBTF Report. Harris believes the recommendations of the BBTF Report are a good starting point for the work of ERIC⁶ in order to achieve uniform interoperability requirements and final rules for the NPSBN. In particular, Harris proposes that the Commission include in its final rules the following set of minimum requirements, as set forth in the NPSTC BBTF Report:

- Internet Access
- VPN Access to any Authorized Site and to Home Networks
- Status/Information "Homepage"
- Status/Information "SMS-MMS Messaging"
- Text Messaging
- Access to Responders under Incident Command System ("ICS")
- LMR Gateway Devices
- Field-Based Server Applications

While Harris believes that all of these requirements would be appropriate for networks deployed under the Commission's final rules, all of these requirements would not be appropriate

⁶ Harris Technical Comments, *supra* note 3, at 3 and 5-7 (filed Apr. 6, 2010).

for entities deploying under waiver.⁷ In the Commission’s *Order* granting conditional waivers to twenty-one public safety entities for early deployment in the 700 MHz public safety broadband spectrum, each waiver recipient is required to submit to the Public Safety and Homeland Security Bureau a detailed plan for achieving interoperability with other public safety broadband networks (termed by the Commission as an “Interoperability Showing”). Where applicable, implementation of these applications should comply with the relevant sections of the 3GPP Evolved Packet System (“EPS”) and TIA-102 Project 25 standards.

B. Roaming

The technical requirements for roaming, an essential component of nationwide interoperability, must be balanced with the need to maintain the security and integrity of the network. Intra-network roaming policies within the NPSBN should be aligned with the priority access methodology described in Section C (Priority Access) of these comments.⁸ Requirements for inter-network roaming, between the NPSBN and commercial networks, must include robust authentication procedures in order to ensure unauthorized access does not occur in the public safety domain. The authentication procedures described in Section E.3 (Security, Authentication) of this comment,⁹ which are recommended generally for the NPSBN, should also be applied to any commercial subscribers and terminals in order to securely facilitate inter-network roaming.

Harris supports an interoperable architecture with a regional deployed core network infrastructure. Regional Network Operations Centers (“NOC”) should employ N + K redundant

⁷ *Id.*, at 5-7 (noting that adoption of certain elements of the BBTF Report and PSST recommendations as conditions of waiver may be premature).

⁸ See discussion *infra* Section C, pp. 5-6.

⁹ See discussion *infra* Section E.3, p. 8.

architectures, where N elements provide interconnection and perform resource sharing and load balancing, and K elements are available as hot standby equipment. The exact numbers for N + K should be determined by ERIC based on required availability and the amount of regional redundancy. Databases should employ geographic redundancy through clustering and/or mirroring and regional NOCs should be designed to accommodate traffic from other regions in preparation for disaster scenarios.

Harris also supports the deployment of home routed and local breakout roaming architectures. The S6 and S8 3GPP interfaces should be required to support home routed roaming where the S6 interface requires connectivity between the visited Mobility Management Entity (“MME”) and the Home Subscriber Server (“HSS”). The S8 interface requires connectivity between the visited Serving Gateway (“S-GW”) and the home Packet Data Network Gateway (“PDN-GW”). The S9 3GPP interface should be required to support local breakout traffic. The S9 interface requires connectivity between the visited Policy Charging Rules Function (“PCRF”) and the home PCRF in order to retrieve Quality-of-Service (“QoS”) parameters and charging control information for the roaming user.

C. Priority Access

The regulatory framework for priority access must recognize distinct operational scenarios including: (1) operability for day-to-day operations of a public safety jurisdiction; (2) interoperability for collaborative activities between overlapping (federal, state, and local) and adjacent (state-to-state and county-to-county) jurisdictions; and (3) non-collaborative roaming in order to provide use of a serving network for a visiting user. It is a well established practice in current mission critical public safety radio networks to implement priority access and prioritization of user/group access under “normal” operational scenarios, or elevated priority

access for selected users/groups under “emergency” scenarios. Harris recommends that the Commission require similar functionality for Priority Access in the NPSBN. Technical requirements should leverage 3GPP EPS capabilities, where available, and should recognize that public safety extensions to 3GPP standards may be necessary to ensure compatibility with public safety performance requirements. Governance policies should also be established by ERIC to establish standardized protocols for successful implementation. In addition, ERIC should allow for regional flexibility in defining local priorities, as long as the system satisfies the ERIC requirements for minimum priority access.

D. System Characteristics, Interfaces, and Testing

Harris believes that a self-certification process is adequate in the near term, particularly for systems constructed under the waiver process, because final network technical specifications are still being finalized. The vendor industry has a history of successful self-certification regimes with the Land Mobile Radio environment that is being strengthened through the formal P25 Compliance Assessment Program (“CAP”) as the interoperability requirements mature.¹⁰ However, in the long term, a formal standards-conformance process would be appropriate taking into consideration three elements: (1) regional network operators should be required to verify applicable sections of 3GPP EPS standards via established 3GPP Interoperability Test (“IOT”) methods and procedures; (2) standardization extensions above and beyond 3GPP EPS standards should be verified in accordance with the IOT methods and procedures established by the Standards Development Organization (“SDO”) responsible for that standard, such as the Telecommunications Industry Association (“TIA”), Association of Public Safety and

¹⁰ Statement of Ernest L. Hofmeister, Senior Scientist, Public Safety and Professional Communications, RF Communications Division, Harris Corporation, Before the United States House of Representatives Committee on Science and Technology, Subcommittee on Technology and Innovation, Hearing on “Interoperability in Public Safety Communications Equipment,” p. 10 (May. 27, 2010).

Communications Officials-International (“APCO”) or the Wireless Innovation Forum (formerly known as the SDR Forum); and (3) the overarching governance structure of IOT should be the mutual responsibility of ERIC with technical recourses provided by the National Institute of Standards.

It is likely that more than 100 regional networks will be constructed and hence use of a unique Public Land Mobile Network (“PLMN”) for each regional network is problematic. Harris favors the use of a hybrid approach between a single PLMN for the public safety network and multiple PLMNs in accordance with a “Core Network Architecture (“CNA”).” The ‘CNA’ will encompass a pre-defined number of PLMN IDs (on the order of 50) and each PLMN ID will define a semi-autonomous network comprised of regional networks, each with its own sub ID. In large aggregated networks the CNA approach facilitates robust network performance.

E. Security

1. Key Management

Key Management, as defined in the 3GPP standards, requires the establishment of shared information between the network and the user. This is accomplished administratively by entering the shared information in the Home Subscriber Server (“HSS”) and in the UICC of the User Equipment (“UE”). Harris recommends that interoperability be accomplished by ensuring a visiting user has the ability to authenticate by providing a connection between a visited Mobility Management Entity (“MME”) and the user’s home HSS.

2. Encryption

Encryption algorithms are negotiated when the UE authenticates with the network. Encryption will work if there is a cryptographic procedure mutually supported by both the UE and the network. Harris supports the use of 128-bit encryption over the airlink, as well as,

integrity protection of Radio Resource Control (“RRC”) and Non-Access Stratum (“NAS”) signaling, as specified by 3GPP. Security between network elements should employ IPSec tunnels and end-to-end user data should be encrypted from the UE to the access network employing secure tunnels. Support for algorithm selection procedures should be accomplished as specified in 3GPP TS 33.401.

3. Authentication

3GPP defines Authentication and Key Agreement procedures use by the HSS, MME, and the UE to derive authentication vectors and keying material from shared secret information established via Key Management. Harris supports the robust mutual authentication procedures detailed by the 3GPP standards for a UE entering the network. Upon achieving authenticated access to the Radio Access Network (“RAN”), the UE should be required to authenticate with the access network according to the Authentication and Key Agreement procedures detailed in 3GPP TS 33.401.

4. Authorization

Administration of 3GPP Traffic Flow Templates (“TFT”) encompasses the ability to configure applications and data rates for a user. Harris supports the authorization of these parameters through the use of the Policy and Charging Enforcement Function (“PCEF”) in the access gateway and the Data Radio Bearer (“DRB”) in the RAN. Harris recommends the Commission standardize this approach for application authorization. Additional authorization within the EPS may be accomplished on a regional basis through the use of Deep Packet Inspection (“DPI”) in the access gateway.

F. Performance, Reliability, Capacity, and Coverage

Harris recognizes the delicate balance that must be achieved between uniform performance parameters and the variability of requirements that naturally arise within different jurisdictions. However, Harris recommends that the Commission not directly impose requirements on performance, reliability, capacity, and coverage through rulemaking. These very critical performance parameters should be addressed through the governance structure of ERIC, which should be tasked with establishing minimum performance parameters. Within the ERIC governance structure, Harris recommends that licensees be required to submit a “Network Design Showing” (in addition to or part of their “Interoperability Showing”) that sets forth these parameters for the network they contemplate constructing. NPSTC, SAFECOM, TIA, and the Department of Homeland Security have all recognized the importance that governance plays in achieving interoperability.

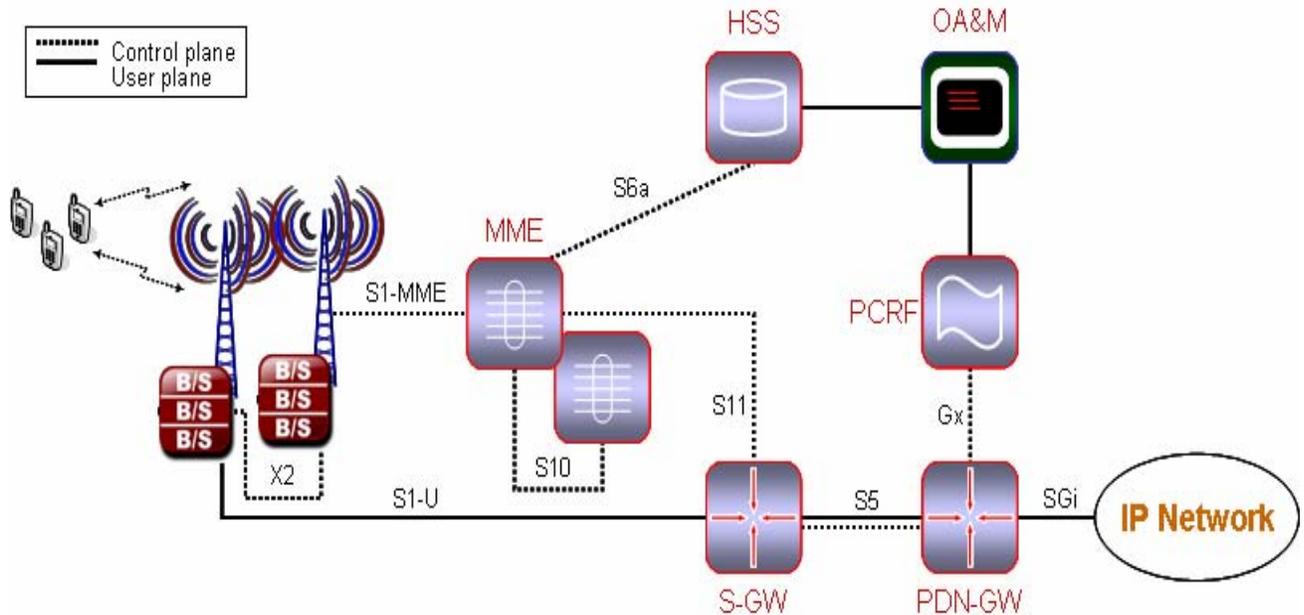
G. Nationwide Core

Harris believes that effective and scalable nationwide interoperability can be achieved through a multiplicity of Core Networks. The Core Architecture should consist of multiple semi-autonomous Core Networks, each of which is the aggregation point for multiple Regional Networks below it. In this Core Architecture, Core Networks should be assigned unique PLMN IDs, where Regional Networks should be assigned sub IDs within the Core Network to which they are aggregated. Core Networks could be assigned a regional designation through existing geographic or Commission boundaries, such as States, Regional Planning Committee regions, Major Economic Areas or other appropriate Commission boundary regimes. In addition, a regional core network could act as a redundant core for a neighboring region if that region were

to loose access to their core network. The Commission should require that all core networks support the following 3GPP interfaces in support of regional redundancy and interoperability:

- Uu – LTE Air Interface
- S1-MME – Control plane interface between eNodeB and MME
- S1-U – User interface between eNodeB and S-GW
- S2a – Trusted Non-3GPP IP Access
- S2b – Untrusted Non-3GPP IP Access
- S5 – S-GW to PDN-GW not crossing PLMN boundary
- S6a – Visited MME to Home HSS
- S8 – Visited S-GW to Home PDN-GW
- S9 – Visited PCRF to Home PCRF
- S10 – MME to MME support for Category 1 handover support
- S11 – Control interface between MME and S-GW
- SGi – Internetworking interface
- Gx – Policy and Charging Control
- X2 – eNodeB to eNodeB interface

EXAMPLE OF NETWORK CORE DESIGN:



H. Network Operations, Administration, and Maintenance

Each Core Network, as defined in Section G (Network Core) of this comment,¹¹ should operate as an autonomous entity with the following mandatory capabilities:

- Fault Management
- Configuration Management
- Accounting/Administration Management
- Performance Management
- Security Management

In addition, roaming agreements between Core Networks should be established by their respective governing bodies and provisions should be made for exchange of Home Location Registration (“HLR”) Database information.

I. Governance

Harris believes that the fiscal and governance structures to which a licensee is subjected should be completely decoupled and independent. For example, reporting of investments and expenditures should not be part of the governance structure of ERIC. To the extent that licensees utilize federal grants, the mechanisms that administer those grants should stand on their own merit. Private investment by a licensee should remain their own private information subject only to the governance structure in which they are funded. Harris endorses the Commission’s requirements for the Interoperability Showing¹² and recommends that this framework continue and be extended to all future public safety broadband spectrum licensees, not only those licensees that are granted waivers for early deployment.

¹¹ See discussion *supra* Section G, pp. 9-10.

¹² Waiver Order, *supra* note 4, 5163-5165, ¶¶ 55-58; 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*, PS Docket 06-229, DA 10-923 (rel. May 21, 2010).

II. OUT-OF-BAND EMISSIONS

In the event the D-Block is auctioned Harris believes there is an inherent risk of harmful interference between the D-Block and the Public Safety Broadband Block (“PSBB”), as articulated in a recent Motorola *ex-parte*.¹³ In an attempt to mitigate problems resulting from the D-Block being licensed on a commercial basis, Harris recommends, at a minimum, the following actions be taken: (1) final OOB rules should be symmetric (*i.e.*, identical between the D-Block and PSBB to ensure protection of each licensee); (2) the use of an OOB specification such as $43 + 10 \text{ Log}(P)$ dB in and of itself is inadequate to limit interference; (3) an additional relevant specification is a suitable definition of receiver Adjacent Channel Power Rejection (“ACPR”); and (4) the combination of OOB and ACPR permit quantifying the impact of cell edge performance when the cell edge of one network is in close proximity to the site/sector location of the other network.

III. EQUIPMENT CERTIFICATION

While deployment of equipment prior to finalized rules inherently poses some risk to early deployments, the valuable knowledge that will be gained from deployment of these early systems far outweighs the risk relative to ongoing rulemaking. Upon changes in the Commission’s rules, prior to final adoption of NSPBN rules, impact to equipment that may be deployed for operations in the PSBB can be minimal so long as the Commission remains within the domain of the currently agreed upon 3GPP LTE standards and interoperability requirements structured through ERIC, the Public Safety Communications Research Program (“PSCR”), vendor input, and Waiver Recipient participation in the PSCR 700 MHz Demonstration Network. In addition, changes in rules that impact field deployed equipment should be done so

¹³ Ex Parte Presentation of Motorola, Inc., In the Matter of Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket No. 06-229 (filed Apr. 12, 2010).

according to a defined timeline established through user and vendor input, largely taking into account joint vendor availability.

The Commission also seeks comment on how licensees and manufacturers plan to address the continued evolution of the 3GPP standard from Release 8 LTE to future 3GPP releases. The primary method manufacturers presently use to adapt product platforms to evolving standards is through software defined architectures. In mandating the use of LTE for the national broadband network, the NPSBN becomes inextricably linked to the work of the 3GPP. In the same manner that a Commercial Cellular Operator manages their networks and subscribers through the evolution of standards, the NPSBN, in its entirety, will have to likewise ensure continued interoperability of the nationwide network. This will be one of the most critical tasks under the network governance structure managed by ERIC.

IV. CONCLUSION

Harris respectfully requests that the Commission take into account the recommendations and endorsements set forth in these Comments when establishing final rules for the NPSBN with regards to interoperability, OOB, and equipment certification. In particular, when developing these technical requirements Harris encourages the Commission do so under a Network-of-Network National Architecture approach comprised of multiple Core Networks each serving as an aggregation point for regional networks within its footprint. Harris also encourages the Commission to expeditiously evaluate and act on newly submitted waiver requests for early deployment. Harris looks forward to continuing to be a part of both the rulemaking process for the NPSBN and build-out of the NPSBN.

Respectfully submitted,

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