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March 1, 2012

(SUBMITTED VIA ECFS; PS DOCKET NO. 06-229)
Jennifer Manner, Deputy Chief
Public Safety and Homeland Security Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: City of Charlotte, North Carolina
700 MHz Public Safety Broadband Network
Clarification of Interoperability Showing
dated Jan. 27, 2012 Version 2.1
PS Docket No. 06-229

Dear Ms. Manner:

In response to questions and comments from the Public Safety and Homeland Security Bureau ("PSHSB") with regard to the Interoperability Showing ("IOS") submitted by the City of Charlotte ("City") on January 27, 2012, the City provides the requested clarifications in the attached document. The IOS, including the instant clarification, reflects the City's commitment to comply with the requirements set out in the Federal Communications Commission's May 12, 2010 Order (FCC 10-79); December 10, 2010 Order (DA 10-2342); January 26, 2011 Third Report and Order and Fourth Further Notice of Proposed Rule Making (FCC 11-6); and January 9, 2012 Order (DA 12-25), recognizing that future adjustments may be required in response to implementation of H.R. 3630 Sections 6201-6303.

Should the PSHSB have further questions or comments, please contact either Chuck Robinson or Steve Koman with the City, or the undersigned.

Very truly yours,

Elizabeth R. Sachs
Counsel for the City of Charlotte, North Carolina

Enclosure

City of Charlotte
IOS Clarification

1) Introduction & Background

Consistent with the requirements established in the Commission's Order, DA 10-2342 dated December 10, 2010, the City reaffirms its commitment to ensure that its system is designed and will be built to provide outdoor coverage at minimum data rates of 256 Kbps uplink (UL) and 768 Kbps downlink (DL) for a single user at the cell edge when subjected to a 70% loading and targeting a 95% coverage area reliability.

2) System Architecture Overview

- The Fortinet firewalls shown in Figures 2a and 2b provide an additional security layer to the inter-connecting "leased" links between the Charlotte data center and the hosted portion of the EPC. LTE signaling and control traffic is not impacted by their presence.

- Separation between jurisdictions sharing the hosted EPC is carefully defined and will ensure that the City has unfettered access to and secure control of its operations:

  - Clear, definitive and secure partitions are in place between different jurisdictions. The separations restrict each hosted EPC jurisdiction to visibility and management of only its own elements, objects and users.
  - Multiple levels of administration are allowed, including the ability to subdivide the domains of managed users within a jurisdiction. These administration capabilities yield tightly controlled visibility and access to subscriber data, allowing jurisdictions to manage their own subscribers (i.e., perform subscriber adds, changes, deletes, manage their priorities, and similar aspects).
  - Jurisdictions are given the possibility to customize feature offerings for their subscribers only.
  - Access Point Names (APNs) can be defined for each jurisdiction, providing members of a jurisdiction secure, walled access to their applications without other jurisdictions being able to access them.
  - The hosted EPC capabilities provide each jurisdiction with a view of the performance/occupancy of their set of eNBs.

- All jurisdictions on the hosted EPC will run the same software release. Alcatel-Lucent will coordinate the upgrade from one release to the next across the different jurisdictions just as, for example, a State-hosted EPC would need to coordinate release upgrades across all jurisdictions sharing the core within the State. Aspects other than the software release, such as subscriber administration, tracking areas, priority schemes, etc., can be specific to each jurisdiction.

3) **Security Capabilities**

Air interface security – corrected table:

LTE Traffic	Integrity Protection	Encryption
UE to eNB RRC signaling	Supported by UE and eNB	Supported by the UE and eNB
UE to MME NAS signaling	Supported by UE and MME	Supported by the UE and the MME
UE to eNB User Plane	Not supported by 3GPP	Supported by UE and eNB

4) **Interoperability Testing:** The City commits to provide an Interoperability Test Plan in its first Quarterly Report following service availability and to address its progress in fulfilling the elements of that Plan in subsequent quarterly reports.

- UE to eNB Interoperability: The City will require all UEs to be capable of interoperability in the public safety portion of Band 14 with at least two eNBs from different vendors for both LPA and HPA. To ensure this capability, Charlotte will require all device manufacturers to successfully undergo IOT in Alcatel-Lucent's IOT lab prior to deployment in the Charlotte network. The Alcatel-Lucent IOT lab will leverage the CTIA test plan for LTE interoperability, which defines a suite of tests for the UE to E-UTRAN interface. A preliminary version is currently available while the official version is planned to be publicly available February 27, 2012 at http://www.ctia.org/business_resources/certification/index.cfm/AID/11259. Additionally, prior to deployment on the network, device manufacturers will be required to document or provide their plan for device certification with another eNB vendor. In the highly unlikely event that the testing of a device with another eNB should fail to confirm interoperability, the parties, including the City, Alcatel-Lucent and both the device and eNB manufacturers, will work cooperatively to resolve the matter as promptly as possible. Device interoperability testing is expected to be completed sufficiently in advance of service availability to allow time to resolve any issues discovered during testing.

- eNB to UE Interoperability: Alcatel-Lucent has demonstrated that its eNBs are interoperable in the public safety portion of Band 14 with at least two UEs of different manufacturers for both HPA and LPA through IOT, PSCR and other testing. Additionally, pending availability of multi-sourced devices, the City plans to select devices from more than one manufacturer, all of which will go through the Alcatel-Lucent IOT lab to be tested with the Alcatel-Lucent Band 14 eNBs.

- EPC to EPC Interoperability: The City will ensure that its hosted EPC is able to interoperate with the EPC of at least one other vendor. It intends to utilize the services of an IPX provider to interconnect with other sub-networks' EPCs. Alcatel-Lucent's required key interfaces, S6a and S5, are fully standardized, available in the initial network deployment, and already interoperating with other vendor's equipment

in commercial LTE networks. In that regard, a whole suite of interface tests which are available today could be leveraged for testing with other vendors' sub-networks if requested to do so.

5) **Conformance Testing:** The City commits to ensuring that all deployed device models have been conformance-tested by their vendors against either (i) FCC-specified testing procedures adopted pursuant to the January 26, 2011 Third Report and Order and Fourth Further Notice of Proposed Rule Making (FCC 11-6); or (ii) PSCR-recommended augmented test criteria of the PTCRB conformance testing.

6) **Public Safety Roaming**

- LTE Interfaces to Support both HPA & LPA: The City intends to achieve service availability the week of June 30, 2012, at which time it plans to have the following APNs:

  - HPA APN for access of City personnel to their internal applications (<Home APN name>.publicsafety);
  - HPA APN for device management (<mgmt entity>.publicsafety);
  - LPA APN that provides local access for visiting users from other Petitioners' networks (local.publicsafety); and
  - LPA IMS APN for IMS services (ims.publicsafety).

  The City's APNs will remain consistent with the Public Safety 700 MHz Demonstration Network, Network Identifier Guidelines, Version 1.0, published in January 2012. The S6a and S5 interfaces are the key interfaces for the support of HPA and LPA. Alcatel-Lucent's deployed infrastructure already interoperates with other vendor HSSs in commercial networks, validating its S6a interface. Moreover, Alcatel-Lucent's SGW is also commercially deployed with other vendor's PGWs, thereby validating the interoperability of Alcatel-Lucent's S5 interface.

- Configuration of Devices and Network Equipment (including network identifiers): As described above, the City's network, including devices, will be configured to support both HPA and LPA access. APN names, as specified by SAIC's naming guidelines with a targeted availability of March 9, 2012, will be used. The City will ensure that the DNS names associated with Charlotte-specific HPA APNs (custom APNs), as well as Alcatel-Lucent's HSS, are propagated to the selected IPX service provider(s), thereby enabling proper routing from other sub-networks to the City's HSS and PGW. As part of the arrangement with the IPX service provider(s), the IMSI range associated with the City's network will be shared with the IPX in order for diameter routing of Charlotte subscribers to be established. The City anticipates having this capability in place by October 31, 2012.

- HPA and LPA Sub-network Interconnection: The City will utilize the services of an IPX provider for the interconnection with other sub-networks by supporting both HPA and LPA at launch:

- To support LPA, the City's EPC needs to support the common APNs defined by NIST. At the time of service availability, it will support the local.publicsafety and ims.publicsafety APNs. Since mission critical voice is not available initially, the mcvoice.publicsafety APN will not be supported at that time. LPA utilizes the same interfaces in the City as are used by Charlotte's own users when accessing their home APN, hence the S6a interface is the only external interface required.
- For HPA, the City will use the PGW information obtained from the visiting user's home HSS. If an IP address is provided for the home PGW, the EPC will route to this IP address via the IPX provider. If an FQDN is provided for the PGW, the City's hosted MME will do a DNS query to the IPX to resolve the FQDN of the home APN and route it to the resulting IP address, again via the IPX provider. For HPA, both the S6a and S5 interfaces are required.

7) **Interference Mitigation:** The Commission's Order, DA 10-2342, dated December 10, 2010, specified the use of the Static Inter-Cell Interference Coordination ("Static ICIC") feature among eNBs to ensure non-interfering operation. Since Static ICIC effectively implies the selective use of a pre-provisioned, i.e., static, specific set of radio resources in order to minimize interference at the edge of a cell, the dynamic nature of incidents, whereby hot spots can be present anywhere within cells, runs contrary to that interference mitigation premise. The City believes that Frequency Selective Scheduling (FSS) is better suited for this dynamic environment for both intra-jurisdictional and inter-jurisdictional interference mitigation. With this technique, adjacent neighbor cells are treated in the same fashion as adjacent intra-cells. Therefore, the City plans to request a waiver of this particular requirement.