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## **Notice of Inquiry Response**

### **FirstNet - NTIA**

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# 1 Document Control

## 1.1 Revision History

Revision Number	Date	Name	Revision
1.0	11/1/2012	Claudia Grandjean	Submission

## 1.2 Reviewers

Reviewer	Date	Feedback
Claudia Grandjean	11/1/2012	Approved

## 2 Executive Summary

AIRCOM International Inc. is delighted to submit this response to NTIA's FirstNet Notice of Inquiry targeting the conceptual network architecture presentation made at the FirstNet Board of Directors and the solicited input on the network design and business plan consideration.

AIRCOM agrees and shares the same thoughts of leveraging the available and existing by commercial wireless industry and the public sector. The wireless industry has proven that building a standalone network is not viable due to the long rollout time frames and associated high CAPEX/OPEX. On the other hand, appointing a single nationwide wireless operator deployment agreement becomes a single point of failure, a threat, and a reliability burden.

A blended diverse nationwide network with multiple wireless networks and systems is most ideal to achieve the desired objectives. The Active RAN Sharing technology specified by the 3GPP standards and its implementation by the OEMs offers FirstNet a platform and a road to deploy a logically independent network by sharing the majority of the RAN active and passive infrastructure.

The security, resiliency, and network availability is critical given the nature of the network users and the data transmitted alongside the QoS and pre-emption requirement. AIRCOM recommends an isolated and independent nationwide core network with integrated NOCs to be established. The sharing will of the core network is not delivery any major CAPES and OPEX savings. On the contrary, if the "heart" of the LTE network is shared then the risk of the network, data, and users of being compromised and breached is high.

FirstNet LTE public safety network is the first and biggest deployment of this nature worldwide. The security, QoS, and specific applications integration requirements with the LTE technology add further complexity to the deployment. As a first step, AIRCOM is recommending the appointment of a PMO team to develop and validate the design, manage the network rollout, and accept its performance. The agnostic nature of the elected PMO is paramount for project success. The PMO will be responsible for breaking down the scopes and developing dedicated RFPs targeting RAN Sharing, National Core Network and NOC, Security and Applications.

AIRCOM International is a global independent provider of network services and tools. Recognized as the market leader in the provision and deployment of network engineering solutions, AIRCOM's products are in use across 135+ countries by over half the world's mobile operators. Every day, the 20 top global operators depend upon AIRCOM's tools and services to improve network coverage and quality for more than 1.1 billion subscribers worldwide.

Established 15 years ago, we have built our reputation on creating and releasing additional value from within cellular networks. AIRCOM is contributing to the United States Wireless Industry through assisting operators accurately and efficiently, design, rollout, operate, and manage the various technology infrastructures. At the present time, two of biggest Commercial Network Planning and Performance Management platforms in the world reside in the United States and are powered by AIRCOM International's technology.

## 3 Overview

This document presents AIRCOM's viewpoint and comments to NTIA's Notice of Inquiry pertaining to the conceptual network architecture presentation made to the FirstNet Board of Directors held on September 25, 2012.

The response includes considerations around various approaches and models targeting the network design strategy, rollout plans, partnerships, and business models. These

considerations support a deployment of a broadband Public Safety Network that adopts a common architecture, leverages existing commercial mobile operators' infrastructure.

The response addresses key topics with multiple short, medium, and long term benefits:

- Project Management Office
- Holistic Network Design & Strategy Validation
- Network Deployment Models
- Procurement Viewpoints
- Commercial Mobile Operator Partnerships
- Beyond Public Safety Use Cases

## 4 Project Management Office

Given the critical nature of the project represented in aiding the First Responders and other government bodies in delivering their jobs successfully, meet FNN project timelines, and deliver this project in a timely and cost effective manner; it is imperative that the FirstNet Board consider establishing or appointing a Project Management Office (PMO) to translate and execute upon the objectives set forth by the board. The PMO office needs to be accountable to the FirstNet Board. The independent trait of the selected PMO is paramount to the program technical, financial, and deployment success.

The PMO office is be responsible for the overall strategy, minimum specifications definition and RFP guidelines, engaging domain experts to review and assess plans throughout the project life cycle, evaluate and score RFP technical responses, deliver initial network dimensioning and nominal design validate final designs, and jointly work with the operation and maintenance provider to measure, validate, and accept network performance.

## 5 Holistic Network Design Criteria & Strategy Validation

LTE is a proven technology that has been deployed to meet commercial grade mobile network design criteria and objectives requirement. It is to be noted that adopting similar design criteria and objectives will not meet the Public Safety Network considerations.

FirstNet's Public Safety Broadband Network (PSBN) is designed to be secure, reliable, resilient, redundant, and interoperable capabilities to be deployed and maintained within the allocated budget. In addition to NTIA's criteria; it is critical that FirstNet agnostically model, dimension, and validate the design criteria and strategy and capture the technical, commercial, deployment, and use case merits.

This effort is crucial to ensure project success as it aligns expectations and defines stakeholders' accountability whilst identifying project critical paths. The independent PMO is best suited to lead and drive this effort with the various independent domain experts and industry stakeholders.

## 6 Network Deployment Approaches

NTIA have outlined the criteria that the solicited proposals need to reflect. The approaches identified below concur with NTIA objectives requiring the proposals to:

- Meet public safety's requirements for priority, quality of service, and pre-emption features
- Uses, to the extent possible, existing radio access network and core network infrastructure installed by commercial mobile operator in order to maximize the coverage and performance delivered to public safety while minimizing the capital expenditure
- Reaches operational capability as quickly as possible

- Enable voice services (cellular telephony and Push-To-Talk (PTT) both within FirstNet network and well as to/from other commercial networks, including the public switched telephone network (PSTN)

## 6.1 RAN Deployment Approach

The Radio Access Network is the main contributor to the infrastructure CAPEX & OPEX figures in comparison with the core network resources. Moreover, it is considered to be the resource that is impacting network readiness due to the nature of the site rollout process and respective regulatory approvals.

The mobile industry globally has been witnessing a transformation since over 5 years relating to the management and ownership of the cell site network infrastructure. This has been driven by industry price pressures and the realization that site acquisition/build criteria is not serving as the differentiator anymore. Instead, the focus is shifting towards strengthening the brand, product, and manages customer experience.

As a result, several trends have posed themselves over the last few years characterized by the operators divesting and consolidating their RAN infrastructure. This trend has also driven the 3GPP and subsequently the OEM community to introduce features that enable and support active network sharing. This enablement allowed operators to take the passive network sharing model to the next level.

This section presents the various models that can be adopted allowing for re-use of existing commercial carrier infrastructure in order to reach operational capability swiftly. It also presents the benefits, assumptions, challenges, and areas of further development.

### 1. Model 1: National Roaming

- a) Benefits:
  - Maximized coverage based on combined commercial Mobile Network Operators (MNO) service footprint
  - Short “time to deploy” as subset of EPC is required for roaming
  - Best coverage / CAPEX ratio
  - Increased resilience to certain types of cyber-attacks due to blend with commercial traffic
- b) Assumptions
  - MNOs are capable to support roaming on their EPC
  - PLMN(s) are allocated to FNN
  - FNN has operational subset of EPC required for roaming
- c) Challenges/Obstacles
  - FNN traffic in visitor network is subject to Deep Packet Inspection analysis
  - Signaling portion of traffic is not encrypted – TAU/Cell level geo-locating of FNN users is possible
  - Commercial networks are not designed for emergency conditions (traffic load, battery/generator backup autonomy etc.)
- d) R&D

- 3GPP standards conformance tests are required for roaming partner(s) equipment to validate minimum set of roaming functionality and required set of roaming functionality (QoS/Priorities from EUTRAN over EPC to interconnect link between visitor network and FNN)
- SLA procedure (monitoring and control/execution) for normal and emergency situations
- Interoperability test should be performed between FNN EPC and visitors network EPC

## 2. **Model 2: Active Network Sharing**

- a) Benefits:
- Sharing MNO existing infrastructure to access FNN spectrum resources
  - Cost effective utilization of FNN spectrum with multiple EUTRAN vendor specific options – from SW upgrade over additional cell module to new remote radio head with dedicated antennas
  - Possibility to re-route FNN traffic closer to eNodeB to dedicated transmission for improved security during normal operations or to any available transmission during emergency situations
  - Increased resilience to certain types of cyber-attacks due to blend with commercial traffic
- b) Assumptions
- MNOs are capable to support network sharing on their EUTRAN and EPC
  - PLMN(s) are allocated to FNN
  - FNN has operational subset of EPC required for network sharing
- c) Challenges/Obstacles
- FNN traffic in the shared network is subject to Deep Packet Inspection analysis if Gateway Core Network (GWCN) sharing mode is used
  - Signaling portion of traffic is not encrypted – TAU/Cell level geo-locating of FNN users is possible if Gateway Core Network (GWCN) sharing mode is used
  - Commercial networks are not designed for emergency conditions (traffic load, battery/generator backup autonomy etc.)
  - Possibility for FNN spectrum jamming using multiple MNO eNodeBs in case of cyber-attack or miss-configuration
  - Proper network resource sharing under stress created by emergency situation
- d) R&D
- Network sharing implementation specifics related to CM, PM, A/FM and network topology
  - MOCN and GWCN advantages and disadvantages from network security and resilience point of view

## 3. **Model 3: Selective RAN Build**

- a) Benefits:

- Dedicated FNN network designed for emergency situation handling with improved security for secure locations
  - EUTRAN design using coverage overlay for increased reliability vs. MNO designs optimized for capacity handling
  - Easier deployment of emergency vehicle based eNodeB
- b) Assumptions
- FNN NOC capable to support EUTRAN is present
- c) Challenges/Obstacles
- Network cost (both CAPEX and OPEX) is prohibiting this approach as a single one
- d) R&D
- Vendor and feature selection criteria for FNN specific type of deployment

#### 4. Model 4: Hybrid

- a) Benefits: Best from multiple models could be combined
- b) Assumptions: Multiple scenarios are possible
- c) Challenges/Obstacles: Worst from multiple models will be combined
- d) R&D: Optimizing multiple models to create acceptable blend of security level, time to deployment, FNN service cost, and FNN service resilience

It is recommended that a hybrid model approach is adopted to allow for a long term efficient deployment of national blanket LTE coverage. The hybrid model takes into consideration the morphology, available technology and site locations, and the negotiated commercial agreements with the commercial mobile operators.

Depending of the desired deployment timescales, technology & device availability, commercial operators readiness to support FirstNet; an interim short term strategy can adopt a national roaming model to allow for a rapid launch of the PSBN.

The urban and dense urban medium & long term deployment is based on an Active RAN Sharing strategy adopting MOCN and dedicated Public Safety spectrum to achieve the desired security, reliability, coverage, and redundant requirements. This model presents an optimal approach to deliver Public Safety LTE network that is functionally independent, secure, meets the NTIA criteria without sacrificing performance caused by commercial networks. As the MOCN and GWCN on LTE are 3GPP release; it is expected that the OEM support, test, and demo these feature in the lab and on the field to allow public safety applications.

The rural deployment strategy will be either based on Active RAN Sharing adopting MOCN/GWCN approach with a shared Public Safety spectrum or a Selective RAN Build Approach. This decision will be considered and evaluated on a jurisdiction or regional level based upon the negotiated agreements with the commercial mobile operators.

In order to cope with any sudden surge in traffic demand during emergency situations, it is recommended that the national roaming LTE networks be utilized during emergency conditions to handle selected QoS and Priority calls. Additional R&D and testing efforts are required to investigate and optimize the resource allocation during such scenarios.



## 6.2 Core Network Deployment Approach

The functionalities require a nationwide interoperable, secure, mission critical network to be operational and available regardless of the volume of traffic being carried, it is critical that a nationwide core network be established in isolation from commercial networks and distributed in secure locations.

It is to be noted that there is no significant CAPEX savings can be realized by considering a shared EPC network model. Such a consideration can actually jeopardize the critical nature of the system as access to the “heart” of the network combined with DPI based analysis tools can intensify the risk of the network being compromised and breached.

The national EPC core is required to be fully integrated with the national NOC to allow for interfacing with multi-vendor and multi-operator equipment allowing for an agnostic centralized and distributed nationwide monitoring (performance, configuration, alarms, faults, and security), quick and cost effective deployment, an effective approach to track network infrastructure change control.

The technology and the multi-vendor equipment infrastructure exist today allows for a multi-vendor nationwide core to be deployed. However, the selected Active Network Sharing features detailed in 3GPP need to be made available by the OEM vendors and interoperability tested be conducted in the lab and the field.

## 6.3 NOC Deployment Approach

Nationwide NOCs and/or regional NOCs can be deployed independently or in conjunction depending on the design and redundancy criteria to be established. Two approaches can be adopted:

- Two Redundant National NOCs running in a hot standby mode
- Four Regional NOCs (East, Central, Mountain, West) running independently and monitored by a Single Nationwide NOC

The location of the NOCs can coincide with the National EPC Core.

It is to be investigated by NTIA whether the underlying FCAPS platforms can be deployed in multiple hot or warm standby instances. This needs to be demonstrated in the lab or in the field.

## 7 Procurement Viewpoints

It is imperative to outline the short, medium, and long term deployment objectives of the first largest Public Safety LTE Network in the world. It is also clear that the PMO, RAN, National Core & NOC, Security, and Applications are separate overlapping domains that need to be specified and integrated closely. AIRCOM International sees value in independent RFPs specified, controlled, and managed by the PMO office.

## 8 Commercial Mobile Operator Partnership

Partnerships are inevitable with the entire commercial mobile operator in the country. Each operator brings a unique value and contribution to FNN in terms of the technology currently deployed and roadmap, flexibility and cooperation, spectrum allocations, sites and locations, capability to support Active Network Sharing with a quick turnaround time and roaming agreements.

It is suggested that NTIA assess the level of cooperation that the mobile operators are willing to leverage alongside various pricing models to allow for roaming and network sharing agreements

## 9 Beyond Public Safety Use Cases

There are opportunities that FirstNet can investigate to leverage its spectrum, hosted network, national core and NOC to generate revenue or offset some of the costs associated with network sharing. Both opportunities are based upon monetizing the network spare capacity.

The first opportunity revolves around working with the Rural Carrier Associate to provide rural operators access to the 700 MHz LTE network either through roaming agreements or through hosting a cloud based EPC service to meet their specific requirements. This approach is to be investigated and facilitated by NTIA.

The second avenue allows for utilizing FirstNet 700MHz coverage and capacity footprint either to allow selected Tier 1 and 2 operators to expand their LTE service footprint or provide a mechanism to offload their traffic onto FirstNet's LTE FDD network. Again, this approach is to be investigated and facilitated by NTIA.

## 10 Summary

AIRCOM International would like to thank FirstNet and NTIA for issuing this public notice and soliciting feedback from the industry. The efforts that NTIA and the PSCR have placed over the last few years in order to drive this initiative forward have been remarkable. AIRCOM look forward for future engagements and discussions. In addition, we encourage FirstNet and NTIA to take the first steps of identifying the agnostic PMO and the domain experts to assist in driving the initial design criteria and strategy forward alongside developing the respective cost models.