

February 23, 2015

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: Notice of Ex Parte Communication: Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354

This submission is to follow-up on meetings held between FCC staff and representatives from the WiMAX Forum, Utilities Telecom Council, American Petroleum Institute, Exelon Corporation, and CenterPoint Energy Houston Electric LLC on the 8th and 9th of December, 2014¹.

In response to the FNPRM, the above organizations and many others, including Ameren Corporation, Iberdrola USA, GE Digital Energy, Siemens Industry Inc, and Telrad Networks, strongly opposed (and continue to oppose) the inclusion of the 3650-3700 MHz band in the proposed Citizens Broadband Radio Services (CBRS) Band. Our opposition is driven by the fact that there are many incumbents in this band with successful deployments under the current rules². Our position is based on the experimental nature of the proposed rules and the deleterious impact the CBRS regulatory regime would have on incumbents, in particular, Critical Infrastructure³ Industries (CII) and Smart Grid networks.

The net outcome of the above mentioned meetings with FCC staff left us with the view that the 3650-3700 MHz band likely will be included in the CBRS regulatory regime, but that the Commission is considering certain rules it believes will ensure that CII operations in the 3650-3700 MHz band are not disrupted, namely:

¹ <http://apps.fcc.gov/ecfs/document/view?id=60001008666>,
<http://apps.fcc.gov/ecfs/document/view?id=60001008671>,
<http://apps.fcc.gov/ecfs/document/view?id=60001008675>

² There are over 2,500 licenses and more than 39,000 registered sites and more than 100 Critical Infrastructure Industries (CIIs). This band has been an essential foundation for Smart Grid communication networks.

³ *Critical Infrastructure Industry (CII)* includes state, local government and non-government entities, including utilities, railroads, metropolitan transit systems, pipelines, private ambulances, volunteer fire departments, and not-for-profit organizations that offer emergency road services, providing private internal radio services provided these private internal radio services are used to protect safety of life, health, or property; and are not made commercially available to the public. 47 C.F.R. §90.7. Critical Infrastructure includes 16 sectors as described in Presidential Policy Directive dated Feb 12, 2013: <http://www.whitehouse.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil>

1. CII incumbents would be granted incumbent status for five years following the PAL auction, during which time they would be permitted to operate pursuant to the same technical rules that currently govern operations under Part 90.
2. Only after the 5 year grandfather period will grandfathered equipment in the 3650-3700 MHz band be required to be fully compliant with the Spectrum Access System (SAS). During the grandfather period, 3650-3700 MHz licensees would still be required to register sites as required with current rules and applicants that are awarded licenses during the grandfather period would also register sites in accordance with current rules. It is expected that the site locations and certain other operating parameters would be linked into the SAS in anticipation of compliance after the grandfather period.
3. Priority Access Licenses (PALs) will not be adopted for the 3650-3700 MHz band. This 50 MHz segment of the 3550-3700 MHz CBRS will be considered a GAA-only band and incumbents would be assured continued access to their GAA licenses.
4. Other rule modifications will be considered for the 3650-3700 MHz band to ensure that current CII operations in the band are not disrupted even after the five year grandfather period, and that future CII build-outs continue to enjoy the same, or better protections against harmful interference.

The purpose of this submission is to:

- Respond to a FCC staff request seeking more detailed information about typical Smart Grid deployments with respect to use cases and network architectures.
- Suggest rule modifications we consider to be essential to protect incumbents and to support continued build-outs by CIIs and Smart Grid networks in the 3650-3700 MHz band on the assumption that it will be incorporated into the CBRS.
- Express further concerns with the proposed functionality and operational characteristics of the Spectrum Access System (SAS).

SMART GRID DEPLOYMENTS – USE CASES, TOPOLOGIES, AND EXAMPLES

It is important to recognize the challenges associated with the deployment of a Smart Grid network. For end-to-end connectivity the Smart Grid network will typically be made up of a number of sub-networks as shown in the following SG Reference Model⁴.

A Smart Grid network comprises; HANs, LANs, NANs, FANs, WANs and backhaul networks carrying voice, data, and video traffic. Topologies include; point-to-point (PtP), point-to-multipoint (PMP), and MESH and end-user devices may be stationary, nomadic, or mobile. Use cases and applications include Advanced Metering Infrastructure (AMI), Distribution Automation (DA), Supervisory Control and Data Acquisition (SCADA), Wide Area Situational Analysis (WASA) and many others. It is important to note that these are mission-critical and, in many cases, latency-sensitive applications essential for ensuring a

⁴ Source: SGIP-PAP-02 Guidelines for Assessing Wireless Standards for Smart Grid Applications, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=914731

reliable delivery of services to the public. Communication disruptions in any part of the Smart Grid network can result in a local or wide-scale service outage with potentially serious consequences to public welfare and safety and, possibly, damage to utility assets.

Although the Smart Grid network may employ different frequency bands within a single sub-network it is important to recognize the role of the 3650-3700 MHz band as an enabler for CIIs attempting to meet the requirements of Title XIII of the Energy Independence and Security Act of 2007 (EISA).

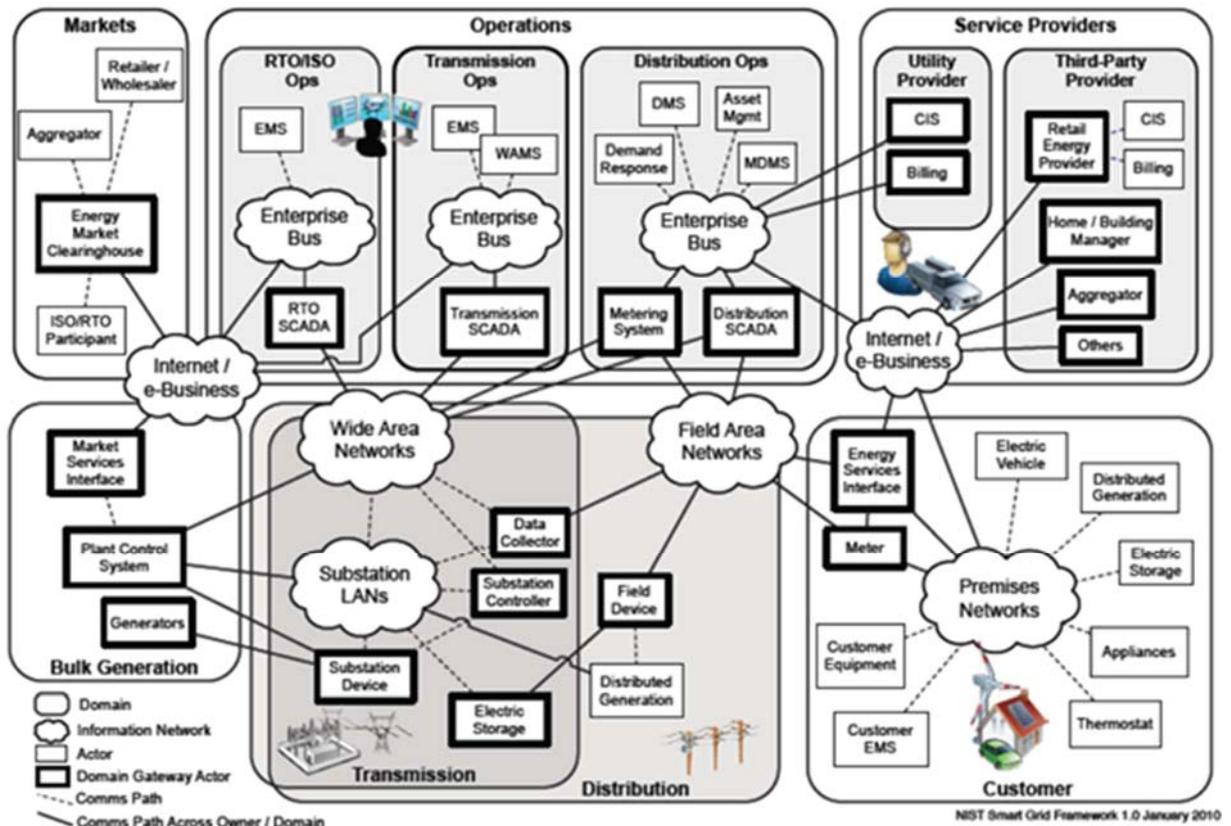


Figure 1: Smart Grid Reference Model – A network of sub-networks

Representative Smart Grid deployments in the 3650-3700 MHz band

There are over 100 CIIs with deployments in the 3650-3700 MHz band that will be impacted by any rule changes adopted for this band if it is included in the CBRS regulatory regime. Although the number of incumbents has grown over the past 2 years, there are many prospective licensees sitting on the sidelines pending the outcome of this proceeding. Incumbent CII licensees range from large entities in large cities to small local rurally-located cooperatives.

The following table provides further deployment information for just a few representative electric and gas utilities with deployments in this band.

TABLE 1: Some representative Smart Grid deployment examples

Name	Number of Customers	Geographic Area	Investment	Use Cases	Network topologies deployed or being considered (typ. range or coverage area per node, etc.)	Critical requirements; latency, availability, thru-put, etc.
Ameren Services Company	2.4 million (IL & MO)	IL (Ameren Illinois) MO (Ameren Missouri)	<p>Supports a Smart Grid & AMI deployment project for Ameren IL over a 10-year period (2012-2021).</p> <p>Investment in this band ~ \$500K thru 2014, this includes engineering consulting, internal engineering, internal field labor, tower contractor, radio equipment, antennas & misc. equipment. 6 APs deployed & 8 remotes installed thru 2014.</p> <p>2015-2021 investment in 3.65 GHz infrastructure (both IL & MO) is expect to be > \$3 million</p>	<ul style="list-style-type: none"> • Common Backhaul for AMI and SCADA • Video • Substation fault recording 	<p>PtP</p> <p>PMP</p> <p>Deployed Maximum range PtP is 17.6 miles.</p> <p>Maximum range PMP is 11.4 miles.</p>	<p>99.9% availability</p> <p>>3 Mbps bi-directional throughput</p>

CenterPoint Energy Houston Electric	2.3 million	Houston and surrounding areas cover 5,000 sq-mi	<ul style="list-style-type: none"> >\$125 million in this band >5,000 remotes >1,000 access points 750 Grid remotes 5,000 additional telecom sites to be deployed over next 10 yts. 	<ul style="list-style-type: none"> Advanced metering infrastructure, Outage management and recovery, Intelligent Grid 	PtP and PMP Use 7 3.5 MHz channels (a total of 25 MHz) with 3-sector BSs and reuse factor of 3	99.999% availability
Exelon (includes PECO, ComEd, and BGE)	6.6 million total customers (gas and electric)	ComEd, Northern IL, incl. Chicago PECO, SE PA incl. Philadelphia BGE, Central MD, incl. Baltimore Service area >15,000 sq-mi	\$65 million capital expense total from past PECO build and current BGE and ComEd builds over the next five years. This does not include yearly operational expenses.	<ul style="list-style-type: none"> Advanced Metering Infrastructure (AMI) Distributed Automation (DA) SCADA Video Circuit Replacement 	PMP and PTP	99.95% availability
Iberdrola USA	2.7 million total customers (gas and electric)	Upstate New York and New England (see following figure)		<ul style="list-style-type: none"> AMI Distribution Automation (DA) SCADA operations Security Video Backhaul 	PtP and PMP	

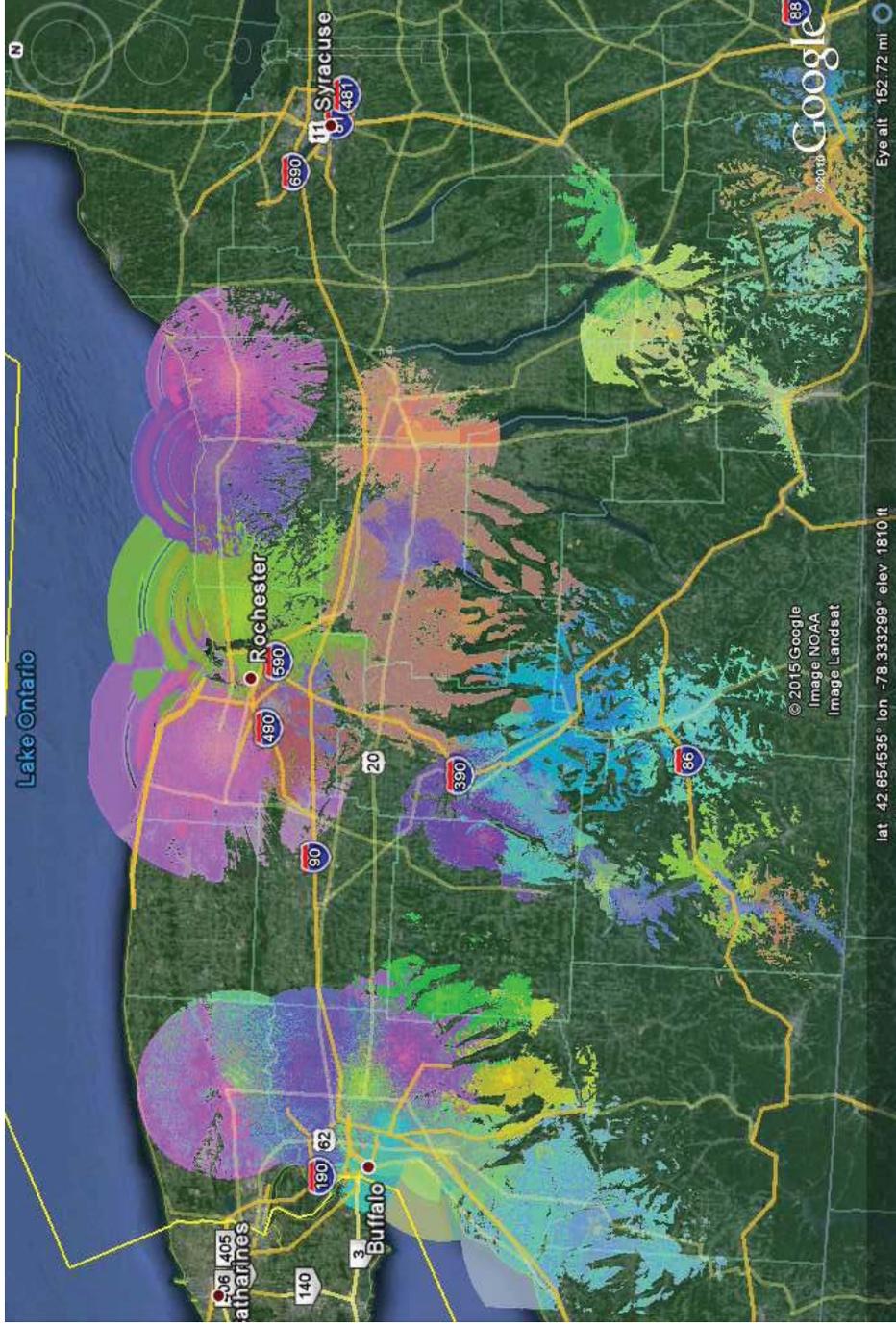


Figure 2: Iberdrola USA Smart Grid deployments covering Rochester, Buffalo, and neighboring regions in upstate New York



MODIFICATIONS TO PROPOSED CBRS RULES

Grandfathering incumbent CII users for five years starting from the date that PAL auctions are concluded in the CBRS band is a positive step towards ameliorating the adverse impact of including the 3650-3700 MHz band in the CBRS, but more is necessary to assure that CIIs can continue to use the 3650-3700 MHz band to meet their critical needs. In the following sections, we address those additional steps that are required.

CIIs must be able to continue to operate under Part 90 rules in the 3650-3700 MHz Band

Part 96 rules must not be imposed in the 3650-3700 MHz band even after the grandfather period, thus allowing existing and future incumbents in the band to operate under the existing Part 90 rules in all demographic regions from rural to urban.

A reduction in the EIRP limit from 30 dBm/MHz (Part 90) to 20 dBm/MHz (Part 96) would result in the need to significantly increase the number of cells to maintain reliable connectivity to all SG end-points. In addition to the considerable investment required for equipment and base station installations it is important to point out the limited availability and increased difficulty in gaining access to suitable sites for the added base stations, especially in urban areas.

Definition of incumbents in the 3650-3700 MHz band

Since many potential applicants for licenses in the 3650-3700 MHz band have held off taking action pending the final outcome of this proceeding and to further encourage the continued use of the 3650-3700 MHz band for CII/SG deployments if the band is included in the CBRS regulatory regime, we propose the following entities also be defined as incumbents in the 3650-3700 MHz band and afforded the same benefits and protections as incumbents with operational deployments at the time the new rules go into effect:

- Entities holding licenses at the time the new rules go into effect
- Entities that acquire licenses at any time during the 5 year grandfather period

As is the case with the current incumbents it will be necessary for new incumbents to register base station sites under prevailing rules for the 3650-3700 MHz band and it is understood that site locations and certain operating parameters would be ported to the SAS.

Defining license geographic areas by census tracts is not a practical approach

We have concerns that the proposed geographic areas for licenses will be defined by census tracts. License areas defined by population density leads to very small areas in urban centers and extremely large geographic areas in low density rural areas. A licensing approach that is not tied in any to typical cell coverage areas or the topology being deployed, PtP or PMP, is, in our opinion, very impractical.

CenterPoint Energy Houston Electric is an excellent example that illustrates the problems with this licensing approach. The following figure shows their cell sites to cover customers in their service area in Houston and surrounding counties. Three sector cells are deployed with channel BWs of 3.5 MHz BW with a frequency reuse of three. Seven different channels are used to provide frequency diversity between cells for interference management.



Figure 3: CenterPoint Energy Houston Electric Deployments in Houston, TX

Figure 4 shows a map of census tracts in the city of Houston (Harris County). There are 746 census tracts in Harris County to cover 2+ million people and approximately 600 sq-mi, ~ 0.8 sq-mi per census tract. The surrounding counties comprising the Houston Metropolitan area raises the total census tracts to approximately 850 with a population of about 6 million.

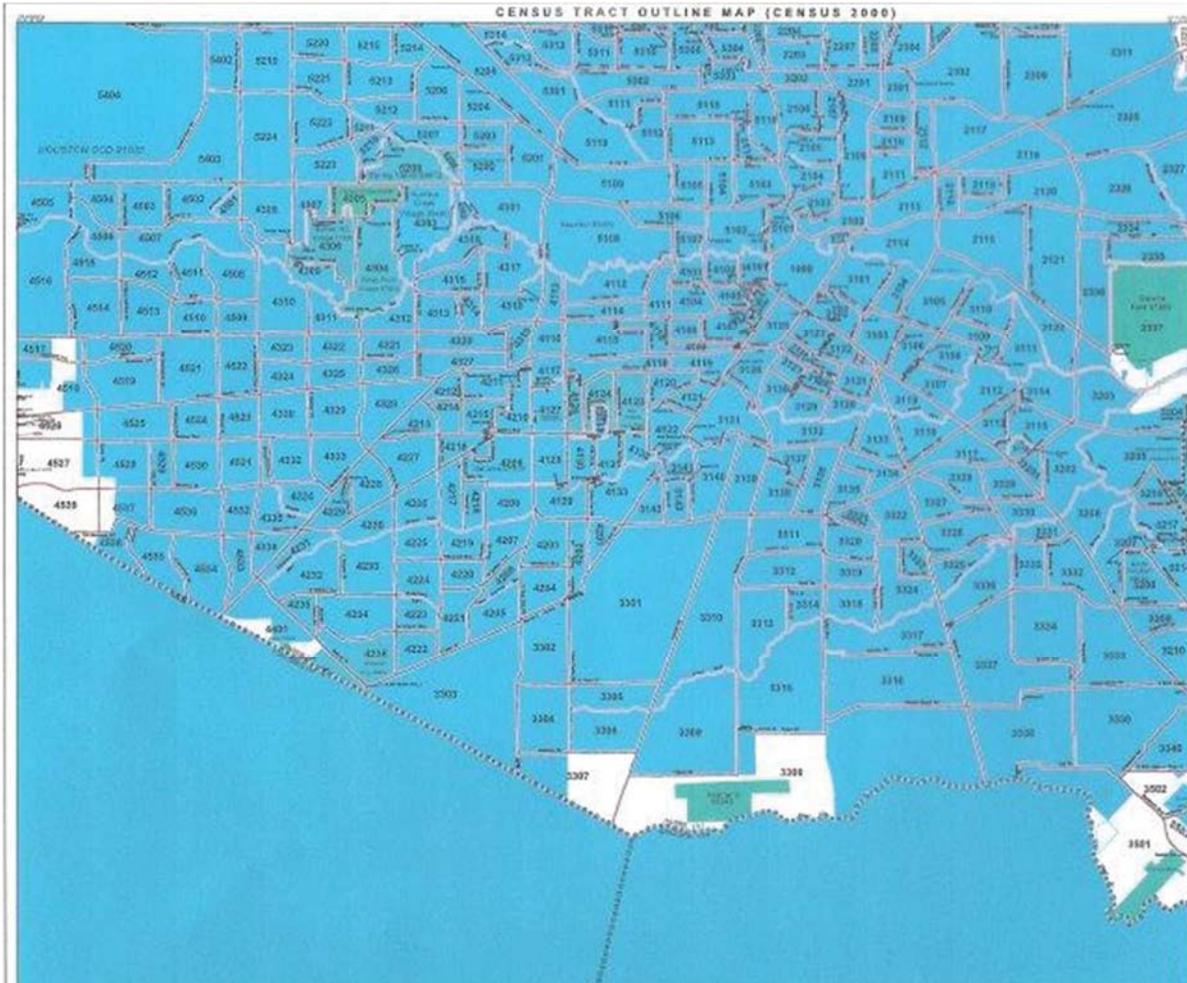


Figure 4: Census Tracts for City of Houston, TX (Harris County)

Figure 5 below shows the coverage area for a single cell site in downtown Houston on the left and in the same location on the census tract map on the right. In this particular case the single cell coverage area encompasses several census tracts.

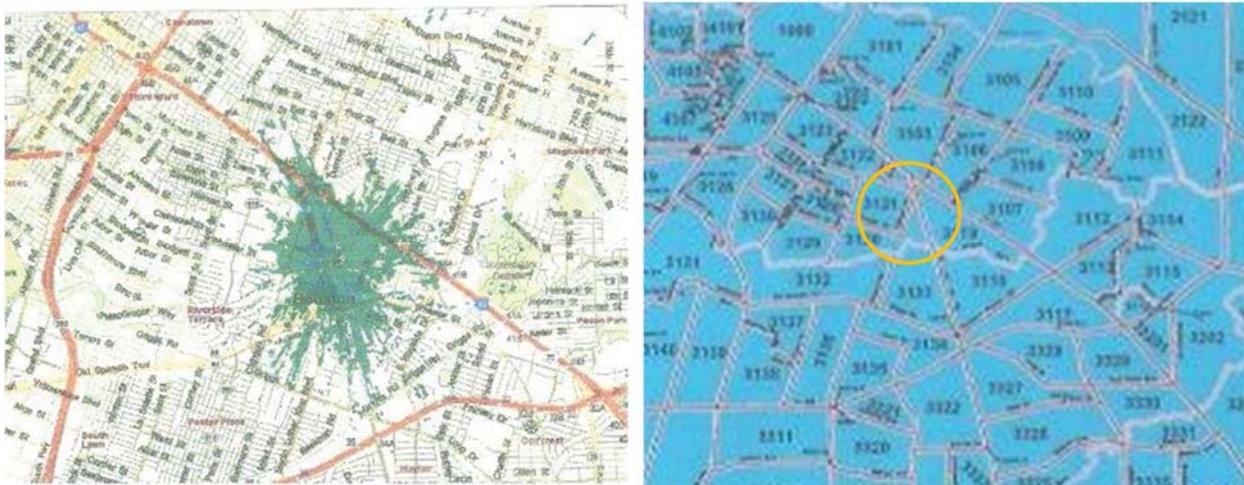


Figure 5: A 3-Sector PMP Cell Site Covers Several Census Tracts

One can certainly argue that if a CII does have permanent GAA access to sufficient spectrum in the 3650-3700 MHz band, which for this example happens to be 25 MHz, the geographic size covered by each license is not an issue. However, what if it is determined that it is essential to have a higher level of interference protection and the CII decides it needs a PA license in the lower 100 MHz of the CBRs band for a specific area in Houston. Getting a license to cover one specific PMP coverage area may require 5-6 separate licenses. If these particular tracts are being contested 1 channel may be available in 1 tract and another in an adjacent tract; not exactly a favorable outcome for a PMP deployment.

Providing longer license terms, bidding credits for CII auction participants or other relief would help, but even then, from a CII's point of view the use of census tracts for the above described scenario is clearly impractical. We further believe that this approach is viewed as unsuitable for many other potential users of this band. The logistics associated with managing several hundred licenses on an annual time frame for a medium to large city would clearly be a significant effort.

Low density rural areas have the opposite problem. Approximately 4% of the US population resides in 72% of the US geographic area. With population densities less than 10 pops/sq-mi, census tracts in these areas can be very large relative to what may be required for either a PMP or PtP deployment.

As an alternative to licensing strictly by census tract, one license per tract, we propose allowing applicants to aggregate census tracts under a single license. An applicant desiring to cover the City of Houston for example would apply for all census tracts within Harris County rather than applying and possibly, having to bid for, more than 700 individual census tracts. This approach would enable an operator, CII or other, to gain access to a single license for wide area coverage that more closely coincides with its service area in more densely populated areas. Even for a single cell site, aggregating 3-5 census tracts would encompass the coverage area for a PMP topology with a single license per channel. This approach also maintains license geographic areas that coincide with census tract boundaries as the Commission desires, while greatly simplifying the licensing process for a Wide Area Network.

This approach does not resolve the issue of a single PA license tying up a larger geographical area than needed in a low density rural region which may, in extreme cases, encompass 1,000 sq-mi or more⁵; significantly more area than required for most deployment scenarios. It can be argued that due to low population density, these regions are not going to be heavily contested for PA licenses and one can always deploy with a GAA license in the unused geographic areas with minimal risk of being over-ridden by the PA licensee.

Contained Access Facilities defined as indoor only

This proposed rule regarding contained access facilities is much too restrictive and MUST be redefined to include outdoor facilities. CIIs have many areas that require secure communications but are not entirely contained by walls. In generally all of the cases the facility will have a fenced perimeter to prohibit unauthorized access. Facilities in this category include electric sub-stations, power generation plants, etc. These facilities require network connectivity for SCADA as well as for video surveillance for protection against malicious vandalism and other potential threats.

We propose this rule be written so as to include “fenced outdoor facilities.”

SPECTRUM ACCESS SYSTEM (SAS)

We continue to have reservations about the functionality and operational characteristics of the Spectrum Access System (SAS) and the potential impact it will have on CII/SG deployments in the 3650-3700 MHz band. Unfortunately, the SAS at this stage is defined only at a relatively high level, and since the FCC apparently contemplates that the 3550 MHz community will determine the specifics of how the SAS will operate, it is impossible for CIIs to determine with any certainty how they will fare under the new regime.

The FNPRM (§ 95) defines the SAS as follows:

“After thorough review of the record and using the TVWS rules as a guide, we propose that authorized SASs would perform the following core functions:

- *Determine the available frequencies at a given geographic location and assign them to CBSDs;*
- *Determine the maximum permissible radiated transmission power level for CBSDs at a given location and communicate that information to the CBSDs;*
- *Register and authenticate the identification information and location of CBSDs;*
- *Enforce Exclusion Zones to ensure compatibility between Citizens Broadband Radio Service users and incumbent federal operations;*
- *Protect Priority Access Licensees from harmful interference from General Authorized Access Users;*
- *Reserve the use of GAA channels for use in a CAF;*
- *Ensure secure transmission of information between the SAS and CBSDs.”*

Our concerns with the role of the Spectrum Access System (SAS) are as follows:

⁵ One of many examples includes Cochise County, AZ which has 32 census tracts for an area 6,165 sq-mi resulting in an average census tract area >190 sq-mi. Census Tract 5 in Cochise County covers more than 1,600 sq-mi.

1. TVWS should be considered only as a reference point and not as a model for deployments in the 3550-3650 MHz and 3650-3700 MHz band. Information such as antennas gains, antenna patterns (both elevation and azimuth), and base station antenna positioning angle must be taken into account in the higher frequency bands. These are parameters that deployments in this band take advantage of to control both self and inter-operator interference. Whereas this detail is not necessary for TVWS in the UHF band it is essential in the higher frequency bands and without it, the SAS will not have sufficient information to assess the potential for harmful interference.
2. CII incumbent applications in the 3650-3700 MHz band must not be subjected to channel changes or reductions in transmit power that may be imposed by the SAS to address what the SAS considers to be harmful interference to or from another operator. These changes can result in end-users being dropped, increased latency with mission-critical data traffic or ineffective intra-system channel reuse. Either of these has the potential to disrupt critically needed services to end-customers and/or cause damage to utility assets.
3. The SAS must not require direct access to individual network end-points or base stations. It should only have access to a specific network via the network management system for that particular network.
4. It is not clear that security that meets the stringent requirements for CIIs and Smart Grid network deployments^{6 7} will be ensured with the SAS as currently proposed. Process control networks, in many cases, are intentionally not connected to the Internet for security reasons. A security breach has the potential for far greater consequences in a CII/SG network than it does in a traditional broadband access network. The Commission must consider alternative access methods to the SAS that do not require connecting secure networks to the Internet.
5. It is also important to note that since there are no itinerant federal systems in the 3650-3700 MHz band, it is not necessary for the SAS to have 10 minute data base updates as proposed for the 3550 MHz CBRS regime. What happens, for example, if the Internet is down, including as a result of a Denial of Service attack, or if the connection from the network management system to the base station has been interrupted when the SAS tries to get a reading ... does that mean the base station(s) must be shut down? We agree that the CII/SG network management system must gain approval from the SAS for a specific site deployment but thereafter should only require an interface when a change is proposed or, perhaps, more frequently but not at 10 minute intervals.

With the understanding that the functionality and operational characteristics of the SAS have not yet been fully defined we offer proactive participation in existing and planned industry-wide groups formed with the purpose of further defining the SAS functionality. We believe it is essential that equipment manufacturers, as well as incumbent operators in the 3650 MHz band, and selected standards organizations be involved in this process. Without buy-in from entities with a vested interest we believe the SAS is likely to fail. The Commission must ensure that as the SAS is better defined, CIIs and all with a vested interest have a say.

⁶ <http://nvlpubs.nist.gov/nistpubs/ir/2014/NIST.IR.7628r1.pdf>

⁷ Each NERCnet User Organization shall adhere to the requirements in Attachment 1-COM-001, "NERCnet Security Policy."

We also suggest that it may be advisable to implement two SAS versions initially, one in the lower 3550-3650 MHz band and another in the 3650-3700 MHz band. The lower 100 MHz would include the full dynamic functionality envisioned for the SAS, while the SAS implemented in the 3650-3700 MHz band, with CII incumbents, would be a more limited version that includes the complete data base but gives operators final say on any channel or transmit power changes. Ultimately, perhaps before the 5 year grandfather period, the two versions may converge into a single solution with time-proven functionality somewhere between the two initial versions.

SUMMARY AND CONCLUSION

We continue to believe the simplest approach to ensure further development of Smart Grid networks and the protection of the numerous incumbents is to exclude the 3650-3700 MHz band from the CBRS regulatory regime. At the same time, we appreciate the pressures to achieve greater spectrum efficiencies on a wider scale and the Commission's proposals help to further that cause.

On the assumption that the 3650-3700 MHz band will be included in CBRS regulatory regime, we believe that what we have proposed in the way of rule modifications specific to the 3650-3700 MHz band are relatively modest and reasonable.

Respectfully submitted,

THE WIMAX FORUM

Declan Byrne, President

UTILITIES TELECOM COUNCIL

Brett W. Kilbourne, Vice President & Deputy General Council

AMERICAN PETROLEUM INSTITUTE

James Crandall

AMEREN CORPORATION

Ken Neiman

CENTERPOINT ENERGY HOUSTON, LLC

Eli Rivera

EXELON CORPORATION

Mark D. Rosenstock

IBERDROLA USA

Peter Stritzinger

GE DIGITAL ENERGY

Craig Tedrow

SIEMENS INDUSTRY INC

Noam Ivri

TELRAD NETWORKS

Chris Daniels