**Before
the**

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

In the Matter of	)	
	)	
Amendment of the Commission's Rules	)	GN Docket No. 12-354
with Regard to Commercial Operations in the	)	
3550-3650 MHz Band	)	
To: The Commission	)	

COMMENTS OF IEEE DYNAMIC SPECTRUM ACCESS NETWORKS STANDARDS COMMITTEE (DYSPAN-SC) ON COMMERCIAL OPERATIONS IN THE 3550-3650 MHZ BAND

The IEEE DySPAN Standards Committee (DySPAN-SC) hereby submits

its Comments on the above-captioned Proceeding. The document was prepared

and approved unanimously by the 1900.5 Working Group within the DySPAN-

SC[1-2].

The IEEE DySPAN-SC is the leading consensus-based industry standards body

for Dynamic Spectrum Access Networks (DySPAN), and has the following

technical scope:

- dynamic spectrum access radio systems and networks with the focus on improved use of spectrum,

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[1] The IEEE DySPAN Standards Committee was formerly known as the IEEE Standards Coordinating Committee 41 (SCC41).

[2] This document represents the views of the IEEE DySPAN-SC. It does not necessarily represent the views of the IEEE as a whole or the IEEE Standards Association as a whole.

- new techniques and methods of dynamic spectrum access including the management of radio transmission interference, and

- coordination of wireless technologies including network management and information sharing amongst different dynamic spectrum access radio networks.

We appreciate the opportunity to provide these comments to the Commission.

Introduction

1. The IEEE DySPAN-SC commends the Commission for its work in developing this NPRM and for soliciting input focused on sharing between Federal and non-Federal systems in the 3550-3650 MHz band.

2. The IEEE DySPAN-SC strongly believes that dynamic spectrum access (DSA) technologies and techniques have the potential to enable more efficient utilization of precious spectrum resources, and should be thoroughly investigated to identify shared spectrum access solutions for the 3550-3650 MHz band. The DySPAN-SC further believes that the benefits of the DSA techniques requires a regulatory framework that will encourage business development of products and services that utilized advanced DSA technologies. The acceptance of these advanced technologies by both the business and regulatory communities is dependent on DSA standards developed by international Standards Development Organizations (SDOs) such as the IEEE DySPAN-SC. Thus, the regulatory community, the wireless industry, and SDOs must work in close harmony to achieve the spectrum efficiency benefits associated with DSA radio systems and networks. This NPRM is a critical component of creating this harmonious relationship.

3. The IEEE DySPAN-SC would like to further emphasize the importance of collaboration between commercial industry and Federal/non-Federal government on developing standardized technology solutions to achieve success in sharing the 3550-3650 MHz band. Both industry and government must commit resources to participating in SDOs to standardize solutions that provide maximum benefit for increased spectrum utilization between Federal and non-Federal sectors.

The work being conducted under the IEEE 1900.5 working group, Policy Language and Architectures for Managing Cognitive Radio for DSA Applications, is directly applicable to sharing in the 3550-3650 MHz band. The P1900.5 working group is standardizing a method for modeling spectrum consumption. The applicability of this work to the areas identified in this NPRM is outlined below. While this response centers around the work being completed by the P1900.5 working group, the DySPAN-SC encourages industry and Federal/non-Federal government sectors to identify further areas for standardization, identify the appropriate SDOs to pursue those areas, and start new working groups.

4. In the text below, the DySPAN-SC provides comments related to several sections of the NPRM.

Description of the Spectrum Consumption Modeling (SCM) standards work

5. The IEEE DySPAN-SC P1900.5 working group seeks to standardize an approach to model spectrum consumption called spectrum consumption models (SCMs). SCMs are used to capture the boundaries of RF spectrum use by devices and systems of devices. These models enable Model-Based Spectrum Management (MBSM), which is spectrum management executed through the creation and exchange of SCMs. MBSM allows distribution of the spectrum management problem where spectrum users can model their use of spectrum independent of other users and place those models in a MBSM system where common algorithms arbitrate compatibility. These models are machine readable and thus serve as a means to convey RF spectrum use digital policy to devices in support of emerging policy-based spectrum management (PBSM) systems. SCMs could be a core component of any future national Spectrum Access System (SAS). SCM is only one aspect of DySPAN-SC work which we present here because of its potential relevance to the FCC NPRM and its potential to be used to assist the NPRM.

6. The IEEE DySPAN-SC P1900.5 working group has recently begun this work. It will be based on concepts from work completed by The MITRE Corporation.[3] The P1900.5 working group's goal is to complete this standard within 18 months. The PAR approval is in process and this work will be documented as IEEE standard 1900.5.2.

Goals of SCM and their relevance to the NPRM

7. SCMs capture the boundaries of spectrum use by capturing the key characteristics of RF systems and phenomena that determine spectrum use. Currently, the modeling method uses 13 constructs that can collectively capture transmission power, spectral emissions, receiver susceptibility to interference, intermodulation effects, propagation, antenna effects, location (both fixed and mobile), time of use, radio behaviors that enable compatibility, and the certainty of what is modeled.

8. SCMs are complemented with defined methods for arbitrating the compatibility between models. A MBSM system is thus capable of managing coexistence among multiple types of users. Coexistence can be managed among types of users as differentiated in the tiers proposed by the Commission or as proposed by QUALCOMM. Models can be made of any type of system that uses the RF spectrum and so compatibility can be managed among types of users differentiated by the purpose or service of their spectrum use, e.g., the radio location service of radar and the land mobile radio service of broadband. These methods support arbitrating compatibility based on both noise limited and interference limited sharing criteria.

9. The SCM data schema is narrowly focused on spectrum consumption. It does not capture user identities, RF component nomenclatures, model numbers, equipment capabilities or operational mission descriptions. Rather it provides an assortment of constructs that attempt to convey spectrum use boundaries. The schema may be combined with other schema to add the data elements necessary for a particular business process. This separation allows multiple

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[3] Stine, J.A. and Schmitz, S., MITRE Technical Report, "Model-Based Spectrum Management, Part 1: Modeling and Computation Manual," http://www.mitre.org/work/tech_papers/2011/11_2071/11_2071.pdf.

spectrum management domains to communicate spectrum use to each other without the requirement that they agree to any particular data elements of the business processes which might contain information they do not want to share outside their own domain. Additionally, it is possible to convey spectrum use boundaries of systems while obfuscating the particulars of the systems and their operational missions. A Spectrum Access System (SAS) can be built without the requirement to store sensitive information. This benefits both government users who do not want to reveal their operations or the capabilities of their equipment and commercial users who want to avoid revealing proprietary and sensitive information about the deployment of their systems.

10. MBSM is a natural evolution of the TV whitespace (TVWS) database concept. The models themselves can serve as the equivalent of contours. The model of an incumbent's use of spectrum serves as a contour for the entry of new users. New users can apply for access to spectrum by submitting a model of that use. The methods of arbitrating compatibility identify whether that new use is compatible with the incumbent. If admitted, the model of the new use becomes a contour for the admission of additional uses. Thus, the use of models in spectrum management not only protects incumbents but supports managing coexistence.

11. Models can be used to protect any type of incumbent system. MBSM can manage spectrum at the borders of spectrum use. To do this, MBSM requires models of the systems at the other side of the border that it must protect, models of systems on this side of the border that could interfere with systems across the border, and vice versa. Models can differentiate indoor and outdoor use. MBSM can support all assignment/allotment methods and the different access tier approaches identified in the Notice.

12. Using SCM and MBSM as part of the future SAS will allow this management approach to achieve the full vision of dynamic spectrum sharing and DSA.

13. SCMs are created by users or their proxies as opposed to by a central authority. Methods for arbitrating compatibility among the models are the same throughout the system. This allows distribution of the spectrum management problem so that multiple database administrators can

collaborate in managing spectrum and individual spectrum owners and users can communicate to the system. Holders of spectrum can use models to specify the availability of spectrum. Users of spectrum can use models to convey demand for spectrum. The process of obtaining spectrum requires users to acknowledge the interference that is present. Thus, MBSM reduces the need for large exclusion zones since access requires users to acknowledge the incumbents' rights.

14. Management using SCM can evolve. The system can start with very conservative models that have the effect of creating large exclusion zones, and then, as confidence is gained in the system, less restrictive models can be developed. If a particular model is found to be ineffective at protecting an incumbent, it can be changed to increase protection.

15. SCMs allow modeling of spectrum use for arbitrary spaces and time intervals. This increases the resolution in spectrum management and would allow a SAS to manage differences in spectrum availability that result from different operational uses. A major cause of large exclusion zones is the inability to articulate uses in time and in space. The coastal exclusions zones were created under the premise that a ship could be anyplace along the shore at any time. Dynamic management would allow spectrum users to convey less ubiquitous use. They can still specify use to protect sensitive operational details. Specifying anything less than the current definition of use is a reduction of the exclusion zone.

16. The act of building an SCM of a use of spectrum is the first step of a negotiation. New users of spectrum build the SCM of their use and can refine their use and so their models to be compatible with existing uses and the models of those systems. This process causes new users to acknowledge the modeled level of interference of incumbent users. The use of permanent exclusion zones is not the most effective or efficient means to manage coexistence. However, the use of SCM does not preclude the use of exclusion zones.

17. The use of SCM can assist in commoditizing spectrum. SCM can be used to advertise the availability of spectrum. SCMs can articulate the quanta of spectrum that are available for trade. They can be used in the negotiation for spectrum. Building a SAS using MBSM will enable the

establishment of spectrum markets. Allowing the SAS to support spectrum markets would make the SAS self-supporting.

18. The use of SCM could also simplify the regulation of RF devices. Certifying the SCM constructs of systems would be the core of regulatory oversight. Manufacturers of devices would define the key constructs of their devices (i.e., spectrum masks, underlay masks, intermodulation masks, and in some cases power maps). Regulators would certify that devices operate within the boundaries of these constructs. The SAS would then manage the devices and systems.

Conclusion

19. This standards project of IEEE DySPAN SC Work Group 1900.5 is directly on point with the objectives of the 3550 – 3650 NPRM. The work promises to create the management capability necessary for a SAS in this band; and, as described, this solution would be a catalyst for innovation in spectrum use and in the development of RF devices that can be managed by the system. This standardization work is just starting and so provides the opportunity for industry, federal spectrum users, and government regulators to collaborate in its creation.

References

[1] John A. Stine, Samuel Schmitz The MITRE Corporation; *Model-Based Spectrum Management—Part 1: Modeling and Computation Manual*, http://www.mitre.org/work/tech_papers/2011/11_2071/

[2] IEEE 1900.5 Working Group on Policy Language and Policy Architectures for Managing Cognitive Radio for Dynamic Spectrum Access Applications; http://grouper.ieee.org/groups/dyspan/5/index.htm

Respectfully submitted,

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