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

In the Matter of	)	
	)	
Commission Seeks Public Comment on	)	ET Docket No. 02-135
Spectrum Policy Task Force Report	)	
	)	
To: The Commission	)	

COMMENTS OF IEEE 802.18 ON THE REPORT OF THE COMMISSION'S SPECTRUM POLICY TASK FORCE

IEEE 802.18, the Radio Regulatory Technical Advisory Group ("RR-TAG") within IEEE 802[1] commends the Commission and its Spectrum Policy Task Force ("SPTF") for all of its work to date in the above-captioned Proceeding and hereby respectfully offer our comments in response to the Commission's request for comments on the SPTF's Report (the "Report").

The members of the RR-TAG that participate in the IEEE 802 standards process are interested parties in this proceeding. IEEE 802, as a leading consensus-based industry standards body, produces IEEE 802 standards[2] for wireless networking devices, including wireless local area networks ("WLANs"), wireless personal area networks ("WPANs"), and wireless metropolitan area networks ("Wireless MANs"), all of which require spectrum resources in order to provide the public with the benefits of wireless networking

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

[1] The IEEE Local and Metropolitan Area Networks Standards Committee ("IEEE 802" or the "LMSC")

[2] IEEE 802 Standards currently operate predominantly in unlicensed Part 15 spectrum. More spectrum will be required to meet future needs and we commend the Commission for undertaking the SPTF inquiry and studies.

INTRODUCTION

1. The IEEE 802.18 RR-TAG commends the Commission and its Spectrum Policy Task Force on the exhaustive amount of work that it has accomplished in such a short time in preparing the Report.

2. We believe that the SPTF's mission of providing the Commission with specific recommendations on ways to evolve the current "command and control" approach to spectrum policy into a more integrated, market-oriented approach that provides greater regulatory certainty, while minimizing regulatory intervention, is an important one and that the Report will be of great assistance to the Commission in addressing ubiquitous spectrum issues, including interference protection, spectral efficiency, effective public safety communications, and international spectrum policies.

3. Having acknowledged the quality and quantity of work performed by the SPTF in such a short period of time, we do respectfully wish to offer the following comments on the Report.

4. In the interest of concise, but understandable comments, we will use the major bullet points from the Report's Executive Summary (*in italics*) as a point of reference, followed by our comments in context.

TASK FORCE MAJOR FINDINGS AND RECOMMENDATIONS

?? *Advances in technology create the potential for systems to use spectrum more intensively and to be much more tolerant of interference than in the past.*

We agree. The Commission should promote flexible use and greater sharing of spectrum through the use of advances in technology, using the minimum regulation necessary to ensure that significant interference problems do not arise between users who share spectrum.

?? *In many bands, spectrum access is a more significant problem than physical scarcity of spectrum, in large part due to legacy command-and-control regulation that limits the ability of potential spectrum users to obtain such access.*

We also agree with this observation. Access is a more significant problem than actual scarcity, due to the outdated regulatory regimes that date to the early days of radio communications and have not kept pace with the staggering advances in technology of recent years.

?? *To increase opportunities for technologically innovative and economically efficient spectrum use, spectrum policy must evolve towards more flexible and market-oriented regulatory models.*

While we agree that regulatory models that achieve more flexible use of and access to the spectrum are desirable, "the market" may not, in all cases, be the solution (and "market-oriented" may mean different things to different constituencies). If "market" is always equated to "financial value," this may not always result in the best policy. For example, some users of the spectrum, and the business/marketing models for some types of uses of the spectrum, would be disadvantaged by an "auction it all and let the market decide" approach to spectrum management.

?? *Such models must be based on clear definitions of the rights and responsibilities of both licensed and unlicensed spectrum users, particularly with respect to interference and interference protection.*

While all users of the spectrum should be responsible users, models must exist that accommodate both licensed and unlicensed users and applications. To have a situation where there would always be a licensed service that is "superior" to unlicensed services would inhibit the development and delivery of new technologies and services … something at which the unlicensed uses have clearly demonstrated the ability to excel.

Furthermore, the definition of "harmful interference" needs to be updated and clearly elaborated. For example, harmful interference for data transmission systems could be based on throughput degradations that could be specifically linked to the interferer. Throughput degradations are quantifiable, and directly affect users through losses in quality of service, lost productivity, lost revenue, etc. Throughput degradations also adversely affect spectrum efficiency, due to the increased consumption of bandwidth caused by the retransmissions necessary to reliably deliver data.

?? *No single regulatory model should be applied to all spectrum: the Commission should pursue a balanced spectrum policy that includes both the granting of exclusive spectrum usage rights through market-based mechanisms and creating open access to spectrum "commons," with command-and-control regulation used in limited circumstances.*

We agree completely. Some services may be provided most efficiently in a licensed environment, while others, due to the nature of their markets, require the flexibility of being unlicensed (or, alternatively, "licensed by rule," "licensed by compliance," or "license-exempt" to suggest different terminology and/or status). The fact that a device, service, or application does not require an individual license, nor does it operate under the auspices of a licensee as with cellphone handsets, should not necessarily relegate it to the bottom of the regulatory "food chain" where it may be forced to survive at the relative whim of "the bigger fish."

?? *The Commission should seek to implement these policies in both newly allocated bands and in spectrum that is already occupied, but in the latter case, appropriate transitional mechanisms should be employed to avoid degradation of existing services and uses.*

As we observed above, all users of the spectrum should be responsible users, and we have no desire to cause interference to other users, licensed or unlicensed. We also understand that in some rare situations some form of transitional mechanism may be necessary to allow sharing between licensed and unlicensed uses (or for that matter between two or more licensed uses). However, "I am licensed and you are not …" should not constitute a valid reason for incumbent users of the spectrum to be permitted to perpetually and rigidly refuse any reasonable possibility of allowing others to opportunistically share or otherwise access under-utilized spectrum.

SPECTRUM USE

?? *Preliminary data and general observations indicate that many portions of the radio spectrum are not in use for significant periods of time, and that spectrum use of these "white spaces" (both temporal and geographic) can be increased significantly.*

Many of our members have recognized this fact for a considerable time. We are glad to see the Commission recognize and acknowledge this fact. Given the opportunity, industry could readily, with today's state of the art, develop systems to efficiently take advantage of such "white spaces" in time, frequency, and geographic location, resulting in more efficient use of the spectrum and greater access opportunities for the public. Current spectrum holders should be held responsible for the efficient use of assigned spectrum, in order to preserve their rights to hold spectrum allocations, rather than being granted a license (effectively) in perpetuity to hoard their allocations to the detriment of others who could make good use of unused time and bandwidth.

?? *Additional information and measurement is needed in order to more accurately quantify and characterize spectrum usage.*

We recognize the fact that making extensive spectrum surveys requires considerable expenditure of time and resources and that the Commission, by definition, has limited resources. Therefore, we recommend that the Commission give serious consideration to any credible spectrum usage data provided by potential sharing partners seeking access to spectrum that may be underutilized and promptly initiate an appropriate Notice of Inquiry seeking further data that may be used to make a determination on whether the proposed sharing is feasible or not. Again, current spectrum holders should be held responsible for the efficient use of assigned spectrum, in order to preserve their rights to hold spectrum allocations, rather than being granted a license (effectively) in perpetuity to hoard their allocations to the detriment of others who could make good use of unused time and bandwidth.

THE CASE FOR SPECTRUM REFORM

?? *Increasing demand for spectrum-based services and devices is straining longstanding and outmoded spectrum policies.*

?? *As a result, it is important to evolve from current spectrum policies, which reflect an environment made up of a limited number of types of operations, to policies that reflect the increasingly dynamic and innovative nature of spectrum use.*

?? *The Commission should also strive, wherever possible, to eliminate regulatory barriers to increased spectrum access.*

We agree completely with all three points above. Spectrum reform is needed, and the principles outlined in these points are clearly correct and to the point.

COMMON ELEMENTS OF SPECTRUM POLICY

?? *No single regulatory model can or should be applied to all spectrum, but there are certain common elements that the Commission should incorporate into its spectrum policy regardless of the regulatory model that is used.*
  - ?? *Maximum feasible flexibility of spectrum use by both licensed and unlicensed users.*
  - ?? *Clear and exhaustive definition of spectrum users' rights and responsibilities.*
  - ?? *Policies that account for all potential dimensions of spectrum usage (frequency, power, space, and time).*
  - ?? *Incentives for efficient spectrum use.*
  - ?? *Policies that encourage grouping of spectrum "neighbors" with technically compatible characteristics..*
  - ?? *Periodic review and revision of spectrum rules to account for technological advances and other changes.*
  - ?? *Efficient and reliable enforcement mechanisms to ensure regulatory compliance by all spectrum users.*

We agree with the points above, with one limited exception. While grouping would appear on the surface to minimize interference potential and could be a useful tactic in some situations, it should not be viewed as a panacea because it could prevent innovative approaches which would allow opportunistic spectrum reuse on a non-interference basis between systems with rather different technical characteristics (e.g., see ET Docket No. 02-380, where the Commission is seeking input on the feasibility of unlicensed devices intelligently using unused television spectrum on a time/channel/location basis).

INTERFERENCE AVOIDANCE

?? *Interference management has become more difficult because of the greater density, mobility and variability of radio frequency (RF) emitters. Interference management becomes even more problematic when and if users have been granted increased flexibility in their spectrum use. As a result, the complexity of predictive interference models has increased dramatically, and is expected to increase even more in the future.*

While the statements above are generally true, we do not believe that predictive interference models have become outmoded or useless. Computational power continues to become less and less expensive at a nearly exponential rate, our understanding of propagation and modulation and coding techniques continue to improve, and extensive digital terrain databases are readily available, with the result that increasingly comprehensive modeling tools are continually becoming available. Thus, we believe that reasonable decisions can be made in many, if not most, cases on the basis of a combination of spectrum usage and sharing feasibility studies.

- ?? *The Commission should adopt, where feasible, a more quantitative approach to interference management based on the concept of "interference temperature."*
  - ?? *The interference temperature metric would establish maximum permissible levels of interference, thus characterizing the "worst case" environment in which a receiver would be expected to operate.*
  - ?? *Different threshold levels could be set for each band, geographic region or service.*
  - ?? *These thresholds should be set only after review of the condition of the RF environment in each band. To that end, the Task Force recommends that the Commission undertake a systematic study of the RF noise floor.*

While we agree that a more qualitative approach to interference management (and spectral efficiency, as well) is desirable, we are not convinced that the proposed "interference temperature" metric is the most appropriate vehicle. We note that the SPTF was also uncertain of the overall merit of the "Weff" spectrum efficiency metric proposed in the previously-filed comments of IEEE 802. In light of the fact that there appears to be a lack of clear consensus in with respect to what are the appropriate metrics, we would suggest further discussions and study between industry and the Commission's staff may be advisable.

- ?? *The Commission should consider applying receiver performance requirements for some bands and services, either through incentives, regulatory mandates, or some combination of incentives and mandates.*

Generally, we believe that receiver requirements are best left to industry standards groups. However, some segments of the community of spectrum users may have little incentive on their own to improve the robustness of their systems (including receivers), with the result that they will claim to be unable to share spectrum that could be shared if they employed more robust systems (including receivers). Current spectrum holders and the manufacturers of the equipment for the markets they serve should be held responsible for the efficient use of assigned spectrum, in order to preserve their rights to hold spectrum allocations, rather than being granted a license (effectively) in perpetuity to hoard their allocations to the detriment of others who could make good use of unused time and bandwidth. The point is that in some cases, a mandate designed to provide the necessary incentive may be necessary to improve spectrum efficiency and/or permit increased access to underutilized spectrum.

SPECTRUM RIGHTS MODELS

?? *Based on the principle that "one size does not fit all" in spectrum policy, the Commission should consider a balance among three general models for assigning spectrum usage rights:*
  - ?? *"Exclusive use" model. A licensing model in which a licensee has exclusive and transferable flexible use rights for specified spectrum within a defined geographic area, with flexible use rights that are governed primarily by technical rules to protect spectrum users against interference.*
  - ?? *"Commons" model. Allows unlimited numbers of unlicensed users to share frequencies, with usage rights that are governed by technical standards or etiquettes but with no right to protection from interference.*
  - ?? *"Command-and-control" model. The traditional process of spectrum management in the United States, currently used for most spectrum within the Commission's jurisdiction, in which allowable spectrum uses are limited based on regulatory judgments.*

While we agree fully with the statement "one size does not fit all" in spectrum policy, we would respectfully suggest some modifications or elaborations on the above definitions:

- ?? The "Exclusive use" model should not necessarily preclude an allowance for opportunistic sharing as an "underlay" on a non-interference basis.
- ?? The "Commons" model should not necessarily and inherently mean that there is no right to protection from interference. Some applications that have been developed in a sort of "commons" under the Commission's Part 15 rules have become so valuable to society that consideration should be given to affording them some measure of protection from interference. In effect, we are saying that the Commission should consider providing sufficient flexibility in its policies for more than one type of "commons" and that at least some of these "commons" should, to the maximum degree possible, not be encumbered with licensed users with higher regulatory status, and therefore the ability to "shut down" the users of the commons.

?? *The Commission should expand the use of both the exclusive use and commons models throughout the radio spectrum.*

We presume that the expanded use of both the Exclusive Use and Commons models will result in a reduction in the use of the Command-and-control model. However, we would point out that applications that have evolved in the "quasi-commons" model of Part 15 of the Commission's rules have, despite the "telecom slump," grown at astounding rates and provided great strides in technical innovation during that slump, while other sectors have had slow growth or no growth. Thus, we would hope that the Commission would recognize, and promptly provide for, the need for a considerable allocation of spectrum to the Commons model.

?? *The exclusive use model should be applied primarily but not exclusively in bands where scarcity is relatively high and transaction costs associated with market-based negotiation of access rights are relatively low.*
?? *The commons model should be applied primarily but not exclusively in bands where scarcity is relatively low and transaction costs are relatively high.*

We can only assume that the reference to "*bands where scarcity is relatively high*" probably refers to the bands below approximately 2 GHz, but if that assumption is correct we would make the following observations:

?? It has been stated repeatedly by many parties in this Proceeding that the real scarcity is not so much a scarcity of spectrum, but rather a scarcity of access to spectrum, due to the inefficiency of historical spectrum allocation methods. However, even in the bands below 2 GHz, there would appear to be yet to be exploited opportunities for sharing, as raised in the Commission's NOI in ET 02-380, which recognizes the potential for sharing of unused TV broadcast spectrum.
?? Transaction costs will generally be relatively low in applications that involve centralized control of network infrastructure (e.g. cellular and similar services), but will be prohibitively high in other applications such as consumer electronics, wireless computer networks, etc. where such centralized control does not (and cannot, due to the nature of the application and the market) exist. In other words, transaction costs, in many cases, are more dependent on the application than on the frequency band that the application employs.

?? *Command-and-control regulation should be reserved only for situations where prescribing spectrum use by regulation is necessary to accomplish important public interest objectives or to conform to treaty obligations.*

We agree completely.

?? *Dedication of spectrum in conformity with international harmonization considerations is sometimes appropriate to foster internationally ubiquitous services and economies of scale.*

We agree completely. The globally harmonized allocation proposed for wireless access systems, including RLANs, in WRC-03 Agenda Item 1.5 is a perfect example of this principle.

?? *Spectrum currently set aside for public safety use should remain subject to the command-and-control model to ensure provision of essential life-and-safety services. At the same time, because of the variability of public safety use, public safety users should have flexibility to lease spectrum capacity during lower-use periods to commercial users.*

We agree completely.

?? *Broadcast spectrum should remain subject to the current regulatory model, which is based on statutory public interest objectives. Over the longer term, the Commission should periodically reevaluate its broadcast spectrum policies.*

Every effort should be made to allow opportunistic reuse of unused broadcast spectrum, in fact all unused or underutilized spectrum, by unlicensed devices on a non-interference basis.

?? *With the exceptions noted above, existing spectrum that is subject to command-and-control regulation should be transitioned to the more flexible exclusive use and commons models to the greatest extent possible. In determining whether and how to transition legacy command-and-control bands to more flexible rights models, the Commission should consider several alternative approaches, and should focus first on initiating transition in those bands where additional flexibility will provide the greatest benefits at the least cost.*

We agree completely.

PROMOTING ACCESS TO SPECTRUM

?? *The Commission should, where feasible, seek to designate additional bands for unlicensed spectrum use to better optimize spectrum access and provide room for expansion in the fast-growing market for unlicensed devices and networks.*

We agree completely. One of the major themes in the SPTF's initial inquiry and in the SPTF workshops was the pressing need for more spectrum for unlicensed devices of this type.

?? *In licensed spectrum bands, the Commission should pursue secondary markets policies that encourage licensees to provide access for "opportunistic" uses above the interference temperature threshold through leasing of spectrum usage rights.*

Every effort should be made to allow opportunistic reuse of unused or underutilized spectrum by unlicensed devices on a non-interference basis. As mentioned above, transaction costs will generally be relatively low in applications that involve centralized control of network infrastructure (e.g. cellular and similar services), but will be prohibitively high in other applications such as consumer electronics, wireless computer networks, etc. where such centralized control does not (and cannot, due to the nature of the application and the market) exist. Given that transaction costs, in many cases, are more dependent on the application than on the frequency band that the application employs. While some applications may be able to bear secondary market transaction costs, opportunistic uses of the spectrum should not be reserved only for those applications that can bear them, but rather opportunistic usage should be open to any application that can utilize the spectrum on a non-interference basis.

?? *The Commission should also explore the possible use of government-granted "easements" for some opportunistic uses in new spectrum bands, but should be sensitive to the potential impact of this approach on planning and investment by licensed users.*

We agree, but licensed users should be required to meet "build-out" requirements and load their systems to some reasonable degree with reasonable time frames, not to "warehouse" excessive amounts of spectrum indefinitely as a speculation in a "commodity."

?? *The Commission should explore ways to promote spectrum access and flexibility in rural areas, including flexible regulation of power levels, secondary markets mechanisms to encourage leasing of spectrum usage rights in rural areas, and consideration of rural issues in defining geographic licensing areas.*

We agree completely. However, "rural areas" needs to have a clear definition and it needs to be recognized that areas that are rural today may be subject to significant urbanization in the future.

?? *Experimental spectrum uses should be encouraged through improvements to the experimental licensing frequency coordination process and dissemination of more information identifying bands that are particularly suitable for experimental applications.*

We agree completely.

SUMMARY

5. The IEEE 802.18 RR-TAG again commends the Commission and its Spectrum Policy Task force for the depth, breadth, and quality of its work, as embodied in the SPTF Report.

6. We respectfully urge the Commission to expeditiously issue a Notice of Inquiry seeking further comment on the topics discussed herein, taking into account the recommendations we offer in these Comments, and to proceed as rapidly as possible thereafter with implementation of spectrum policy reforms, particularly the provision of more spectrum for the "Commons" allocation model.

Respectfully submitted,

/s/
Carl R. Stevenson
Chair, IEEE 802.18 Radio Regulatory Technical Advisory Group
4991 Shimerville Road
Emmaus, PA 18049
610-965-8799
carl.stevenson@ieee.org