IEEE 802
Local and Metropolitan Area Network Standards Committee
Homepage at http://ieee802.org/

July 13, 2002

To: Ms. Marlene H. Dortch, Esq.
Secretary
Federal Communications Commission
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Reply to: Carl R. Stevenson
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From: Paul Nikolich,
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Dear Ms. Dortch:

Please find attached both a *Motion to Accept Late-filed Comments* and the *Comments of IEEE 802 in response to the Commission's Spectrum Policy Task force Inquiry*.

Should you have any questions regarding this filing, please feel free to contact Mr. Carl R. Stevenson, the Chair of the IEEE 801.18 Radio Regulatory Technical Advisory Group ("TAG").

Respectfully submitted,

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

In the Matter of	)	
	)	
Spectrum Policy Task Force Seeks Public	)	ET Docket No. 02-135
Comment on Issues Related to	)	
Spectrum Policies	)	DA 02-1311
	)	
To: The Commission	)	

MOTION TO ACCEPT LATE-FILED COMMENTS

On behalf of the IEEE 802.18 Radio Regulatory Technical Advisory Group, the IEEE 802.11, 802.15, and 802.16 Working Groups, and the IEEE 802 Local and Metropolitan Network Standards Committee, I respectfully request that the Commission accept the attached late-filed *Comments of IEEE 802 in response to the Commission's Spectrum Policy Task force Inquiry*.

While we understand that the stated filing deadline for comments in this Proceeding was July 8, 2002, it was impossible for us to meet that deadline for the following reasons:

1. IEEE 802 held its plenary meeting from July 8-12, 2002 in Vancouver, BC, Canada
2. Under IEEE 802's operating rules, which are designed to assure that documents such as the attached comments represent the consensus views of a significant majority of our members, after a document such as this is prepared, it must be approved by the Working Groups and then by the IEEE 802 Sponsor Executive Committee ("SEC") before it can be presented on behalf of IEEE 802.
3. The attached document was drafted by a committee of designated experts during the plenary meeting week, but could only be approved by the Working Groups during their closing plenary sessions and then approved by the SEC at its closing meeting on the afternoon and evening of Friday, July 12, 2002.
4. After SEC approval, a modest amount of time was required for final formatting and preparation for submission.

Therefore, I again respectfully request that the Commission and its Spectrum Policy Task Force accept and consider the attached *Comments of IEEE 802 in response to the Commission's Spectrum Policy Task force Inquiry*.

Respectfully submitted,

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COMMENTS OF IEEE 802 IN RESPONSE TO THE COMMISSION'S SPECTRUM POLICY TASK FORCE INQUIRY

IEEE 802[1] hereby commends the Commission and its Spectrum Policy Task Force for initiating the inquiry in the above-captioned Proceeding and hereby respectrully offers its comments in response to the Inquiry.

IEEE 802 and its members 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.

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

[2] The IEEE 802.11b, 802.11g, 802.15.1, 802.15.3, and 802.15.4 standards all currently use, or are targeted to soon use, the 2.4 GHz Part 15 bands. The IEEE 802.11a and 802.16 standards currently use, or are targeted to soon use the 5 GHz "U-NII" bands.

In the interest of clarity, we will present our comments in context by including the text of the Spectrum Policy Task Force's Inquiry in *italics*, followed by our comments on each question in normal text.

Market-Oriented Allocation and Assignment Policies

Through the years, the Commission has implemented various spectrum allocation and assignment policies and models aimed at fostering more flexible use of the radio spectrum so that this important resource can be put to its best and highest value use. For example, two models have been used for transitioning to a more market-oriented spectrum policy. Under one model, the Commission has granted existing licensees additional flexibility so that incumbents can migrate spectrum to its highest value use. A second model has involved the Commission reallocating bands for flexible use with geographic service areas and auctioning "overlay licenses and unassigned "white space" spectrum to new and existing licensees. This approach may also include rules to require or facilitate band-clearing negotiations between new licensees and incumbents.

We request comment on both the relative effectiveness of the approaches the Commission has employed for facilitating optimal spectrum use and their applicability across different bands with different incumbents' rights. We are seeking suggestions regarding ways in which the Commission can expand its use of these or other policy approaches. In particular,

1. *What specific policy and rule changes are needed to migrate from current spectrum allocations to more market-oriented allocations?*

Given the success of the Commission's Part 15 rules for devices, such as Section 15.247, 15.249, and Part 15 Sub-parts E and F, which do not require individual licenses and which permit flexible use of spectrum with minimal necessary technical constraints, greater emphasis should be placed on expanding the availability of flexible use spectrum without individual licensing requirements and with minimal, technology-neutral regulations.

This would further foster the development and deployment of efficient, cost-effective technologies for a wide variety of services and applications that would benefit the public and promote efficient use (and re-use) of spectrum.

This is not to suggest that this model is appropriate to all services and applications, but only to suggest that there is a relatively broad collection of applications and services that could benefit greatly from the expansion of these principles.

2. *Should current, restrictive service and operating rules applicable in many bands be changed to provide licensees with greater flexibility? If so, in which bands and how?*

Again, many applications and services could benefit from a move from current licensing models to a "licensed by rule" model in which technology-neutral rules encourage the development and deployment of new services, applications, and technologies, rather than more restrictive models which burden users with individual licensing requirements, limit their options, and tend to artificially hold back the rapid progress of technology.

Additionally, it is felt that new wireless access terminal technologies, having the capability to actively monitor their electromagnetic environment and quickly reconfigure their emission characteristics, hold the promise of being able to utilize spectrum on an non-interfering basis with incumbent users. The development of such new systems would be pursued if the FCC adopted a regulatory approach that reconsidered, for example, the traditional wireless applications for bands below 1 GHz.

With the advent and demand for data and Internet communications by the general populace, which is often dispersed over geographically variable rural environments, it is felt that new considerations should be given to appropriately matching spectrum with propagation requirements and need. Incumbent users of the bands below 1 GHz often do not use spectrum ubiquitously and/or continuously. That fact could be beneficially employed to satisfy the communications requirements of remote and rural users.

Satisfying such requirements using current approaches based on microwave spectrum is extremely difficult and costly because of the daunting propagation limitations.

In the past the incumbent users have feared that sharing their allocated spectrum with, for example, low power rural data services, would always create uncontrollable interference. Today, with the advent of extremely powerful signal detection and processing techniques embodied within low cost and intelligent hardware subsystems, there is an opportunity to address such concerns and develop new approaches that would preserve existing uses of spectrum whilst enhancing and broadening its applications.

In short, we believe new and promising applications for bands traditionally excluded for consideration can succeed if a regulatory regime is adopted that is open to the benefits offered by new technologies.

3. *Should spectrum policy be different in different portions of the spectrum or in different geographic areas?*

Our opinion is that spectrum policies should reflect the needs and usage requirements of the markets served by those policies. For example, policies should not attempt to impose uniform requirements across frequency bands or geographical areas that are not in themselves uniform in their characteristics.

   a. *For instance, should the more congested region of the spectrum (i.e., that below 3 GHz) be governed by different policies than the less congested portions of the spectrum? Should different licensing concepts be applied to upper millimeter wave spectrum where propagation characteristics limit the range and small wavelengths enable very narrow beams?*

We believe that, in the past, effective use of the spectrum below approximately 1 GHz has been fostered by the regulated, licensed approach traditionally employed by the FCC. Public safety services, in particular, are best served by a policy that helps to ensure a high level of communications reliability.

However, in the future, there may be cases where a more flexible, non-traditional approach could result in better spectrum utilization and enable the introduction of new services.

At higher frequencies, service-specific policies are not as essential to the proper utilization of spectrum. As noted by the Task Force in their question, propagation characteristics of the microwave and millimeter wave bands are different than for the lower frequency bands.

As such, a license by compliance approach (for example, Part 15 SubPart E devices) presents a better means of promoting spectral efficiency.

b. *Should spectrum policies vary by geographic area according to the relative level of spectrum congestion or use? For instance, should the rules be different in urban areas where spectrum is generally in high demand, than in rural areas where the demand for spectrum is typically low, or in the transition areas – where spectrum demand is somewhere between high and low demand regions?*

Spectrum policies should try to promote effective reuse of band allocations, where feasible. However, care should be taken to ensure that band and/or channel reuse does not create a congestion scenario in the future.

c. *How can spectrum use, congestion and demand be accurately measured and predicted?*

While measuring spectrum use and demand is relatively straightforward, making accurate long-term predictions can be problematic. For example, the IMT-2000 and RLAN spectrum requirements studies presented in ITU-R represent a very large effort to produce a “best effort” estimate.

A preferred method of controlling congestion would be to develop policies that promote the gradual transfer of non-critical high demand traffic from lower frequency based services to those operating at higher frequency bands which are better suited for this purpose (again, taking advantage of the propagation characteristics of the higher bands).

This combined with intelligent re-use and sharing of spectrum below 1 GHz as suggested above would enhance overall spectrum utilization.

4. *Are there circumstances under which adopting more market-oriented allocation and assignment policies would affect other important Commission objectives? For example, could the optimal provision of radio services to or by public safety and public service entities be helped or hindered by more market-oriented spectrum policies? Are there specific market failures that would produce such adverse affects, and what should the Commission do to address these market failures?*

As we are not experts in public safety communicatons systems, nor economists, we believe that this question is not within our area of expertise.

5. *Should more spectrum be set aside for operating unlicensed devices? Should the kinds of permissible unlicensed operations be expanded? What changes, if any, should be made to the rules to accomplish this? Because of the commons aspects of unlicensed use, is there concern that, as congestion rises, spectrum may not be put to its highest valued use? If so, what policies might be considered to anticipate this problem?*

Yes, more spectrum is needed for devices that do not require individual licenses because the market realities of the services and applications provided by such devices renders individual licensing totally impractical. But we consider the "licensed by rule" or "licensed by compliance" terminology more appropriate than "unlicensed," because the market is global, and "unlicensed" has negative connotations in some regulatory regimes. Because many devices in this category are nomadic or mobile, a more globally-harmonized scheme of spectrum allocations and regulatory framework would increase the size of markets, reduce costs for users, and promote innovation.

Additionally, the Commission should consider taking into account in its rules open, globally harmonized standards for services where such standards exist. This also increases market sizes, again reducing costs for users, promoting innovation, and providing assurances of cross-border interoperability that is becoming increasingly important to users in our mobile society and global economy.

The commons aspect does not raise significant issues with respect to the spectrum being put to its highest valued use, because manufacturers have incentives to meet market demands.

However, when increased spectrum sharing between diverse types of devices is contemplated as a mechanism to increase spectral efficiency and provide new, innovative services, requirements for interference avoidance/mitigation techniques should be part of the regulatory framework in order to promote coexistence and maximize the fair and effective use of shared spectrum.

6. *How can the Commission better facilitate the experimentation, innovation and development of new spectrum-based technologies and services through, for example, changes in its experimental licensing rules, increased use of developmental authorizations or promoting demonstration projects?*

The Commission is doing a good job in this area. Experimental licences are not difficult to obtain. They are actually easier and faster to obtain today than in the past due to the Commission's implementation of an electronic filing process.

However, experimentation and development of new technologies can be best encouraged by a regulatory structure that promotes the availability of suitable spectrum for the commercialization of such technologies. The use of flexible allocation policies, along with opportunities to use technology to facilitate spectrum sharing with incumbent uses (that would have been technically impossible a few years ago), and increased emphasis on "licensed by rule" or "licensed by compliance" paradigms will promote these goals.

Interference Protection

According to many observers, the radio spectrum is becoming increasingly congested. As a result, in considering changes in spectrum policy, it is important to consider the ramifications of technological limits on radio operation, particularly with regard to control of interference between radio systems operating in the same area. Because the issue of what constitutes acceptable interference becomes more important with more intensive use of the radio spectrum, the Task Force seeks comment on these issues:

7. *Are new definitions of "interference" and "harmful interference" needed? If so, how should these terms be defined?*

At this time the definitions appear to be adequate, but as technology advances they should be periodically reviewed.

8. *What is the impact, if any, of increased flexibility on how harmful interference should be defined and understood?*

This is unclear at this time. The IEEE 802.18 Radio Regulatory Technical Advisory Group would, however, be interested in participating in the periodic reviews recommended in item 7 above.

9. *Are more explicit protections from harmful interference of (to?) incumbent users required?*

Over time, as demand for spectrum for new services and applications inevitably and inexorably increases, incumbent users should be required, and provided incentives, to transition to more robust and spectrally-efficient technologies. This will accomplish two desirable goals. First, interference problems will be reduced and additionally incumbent users can enjoy increased capacity without demanding additional spectrum allocations.

However, again, the transition to such new technologies should be accompanied by requirements for interference avoidance/mitigation techniques as a part of the regulatory framework in order to promote coexistence and maximize the fair and effective use of shared spectrum.

10. *Does defining power limits (in-band and at service area boundaries) and coordination procedures in the Commission's rules provide sufficient control over interference as new uses are introduced by licensees? What other regulatory measures are needed, if any?*

This question appears to apply to licensed services with defined coverage areas and we believe that it is not within our area of expertise/interest.

11. *Does defining power limits and other measures in the Commission's rules designed to protect against harmful interference affect innovation?*

Not inherently. In fact, as an example, in many applications defining reasonable power limits can encourage innovations such as more efficient use of the spectrum by limiting coverage area and promoting frequency reuse, thus minimizing the potential for harmful interference. Additionally, limiting transmitter power encourages the development of more effective modulation and coding schemes, more sophisticated antenna technologies, etc.

Additionally, power limits for and other technical parameters individual frequency bands should be harmonized to the maximum extent internationally, to provide economies of scale and maximize the marketability and cross-border usability. These benefits of harmonization will encourage the investment necessary for technological innovation.

12. *As technology advances, should what the Commission defines as unacceptable or "harmful" interference correspondingly change in the future? How should rights and obligations of spectrum users be defined to facilitate such changes as well as innovation?*

At this time the definitions appear to be adequate, but as technology advances they should be periodically reviewed. How the rights and obligations of specrum users could be defined to facilitate sych changes in the future is unclear at this time. The IEEE 802.18 Radio Regulatory Technical Advisory Group would, however, be interested in participating in such periodic reviews.

13. *If the Commission adopts new policies to address interference, should the rights of new spectrum users be defined differently from those of the present incumbents? If yes, how?*

No. The spectrum is a public resource and different segments of the public should not be treated differently under the law or discriminated against on the basis of being "newcomers." To do so would both stifle innovation and be fundamentally unfair. New users and incumbent users should equally bear the responsibility for adopting technologies designed to maximize the use of the spectrum and promote coexistence. (See the comments at 5, 6, and 12 as well.)

14. *Should the Commission consider developing receiver standards or guidelines for each radio service that would be used in judging harmful interference? For example, should such standards or guidelines aim to protect receivers that meet or exceed the standards or guidelines, but allow users to use less robust receivers at their own risk? If so,*

We believe that the development of receiver performance standards or guidelines (as part of equipment type acceptance) would be beneficial in addressing the issue of harmful interference. However, an approach that would create two levels of receiver performance for the same category of device would only serve to create market confusion and user frustration.

Knowing the minimum performance characteristics of equipment operating in a particular band will be essential to conducting sharing feasibility studies and designing devices that can share with existing systems, which will promote new applications and increased spectrum sharing and efficiency.

a. *What criteria should be considered in drafting these standards/guidelines?*

Candidate criteria for receiver performance standards include selectivity, susceptibility, dynamic range, local oscillator phase noise, unwanted emissions, etc.

b. *How should the Commission consider protecting legacy receivers?*

We do not believe that legacy receivers should receive indefinite special protection. To do so would encourage stagnation of technology. Adoption of new technology by incumbent users should not be forced too rapidly into either single use or shared bands, and should certainly not be draconian, but commensurate with reasonable equipment life cycles and amortization schedules, while recognizing that such upgrades will also provide benefits to the users that are required to keep up with the times.

c. *Should these standards/guidelines differ among the various radio services*

Yes. Such standards will inherently need to vary according to the application, its required bandwidth, and other factors. However, as long as the minimum requirements are well-known, it will be more practical to design devices that can share spectrum with incumbent users. The facilitation of sharing of spectrum, with coexistence, can greatly increase spectrum utilization in many bands.

15. *In lieu of, or to complement, technical rules related to interference, are there processes that the Commission could consider that would allow private parties to more expeditiously resolve interference issues and disputes, for example, through negotiated agreements, mediation, arbitration or case-by-case adjudication?*

The Commission's Part 15 Rules have served well to ensure performance when individually licensed and unlicensed systems and technologies are nearby or co-located. This has been accomplished with minimal technical constraint and without the need for any processes above and beyond the existing Part 15 technical rules.

However to encourage more efficient spectrum sharing, the Commission may wish to consult with industry regarding the desirability of identifying coordination processes to allow multiple private (and potentially public) parties to improve the efficiency of use of each of their systems, when each of those parties are using nearby or co-located unlicensed Part 15

technologies. Such processes are most applicable to situations when large-scale high cost networks are being considered. The Commission need not undertake any role in issue resolution. These processes are intended to facilitate the parties in their own issue resolution.

Clearly for unlicensed Part 15 operation systems, such processes must not be in lieu of the technical rules, but would be a complement to the existing technical rules. Such processes would be useful if they are determined to improve the aggregate performance of nearby or co-located systems.

Examples of such processes could include;

1. Pre-installation surveys, models and predictions
2. Communications mechanisms between the parties to facilitate awareness of the presence of nearby systems
3. Means to facilitate efficient sharing of infrastructure between parties in cases where the parties intend to use comparable Part 15 compliant devices

16. *Some parties assert that the Commission should adopt rules for interference that are based on economics, and not purely technical, in nature. They argue that efficient interference management should involve an economic balancing between the parties using the spectrum. Would greater use of these types of alternatives lead to more certain and expeditious resolution of interference issues?*

    Not within our area of expertise.

Spectral Efficiency

Due to the ever increasing spectrum demand, increased spectral efficiency will be needed to accommodate future growth. To this end, it is important that spectrum policies create positive incentives to make "efficient" use of the spectrum resource and to continue the development of spectrally efficient technologies. At the same time, regulations should remain technologically neutral, without directly or indirectly determining the success or failure of particular technologies and services. The Task Force seeks comment and information on the following questions on how to promote and measure spectral efficiency:

17. *What mechanisms or policies might be considered as a means of promoting a proper level of spectral efficiency either through regulatory mandates or economic incentives?*

Technology is advancing at an ever-increasing pace. Higher and higher levels of integration and increases in computational power make possible solutions that could not have been envisioned even a few of years ago. Communications equipment has a finite life, and the practical life is constantly being shortened by the advancement of technology and the performance increases and cost reductions that it makes possible.

These continual advancements in technology can also promote increased spectral efficiency and utilization through the use of techniques such as spectrum sharing etiquettes, interference mitigation techniques, dynamic channel allocation mechanisms, adaptive antenna technologies, etc. Such advancements should be encouraged through some combination of regulatory mandates and/or economic incentives.

Incumbents should not be permitted to remain frozen in an antiquated time/technology space virtually forever at the expense of others who require spectral resources as demand for spectrum constantly increases.

The Commission should require incumbents to keep reasonably abreast of the current state of the art in spectral efficiency, and its corollary coexistence and spectrum sharing, through a combination of regulatory mandates and, where feasible, economic incentives. Such means

should certainly not be draconian, but commensurate with reasonable equipment life cycles and amortization schedules, while recognizing that such upgrades will also provide benefits to the users who are required to keep up with the times.

18. *Are there mechanisms that other countries use that should be applied in the United States as well?*

We are not aware of any examples we could recommend at this time.

19. *Do any existing Commission rules inhibit efficient use of the spectrum? If so, how should they be changed?*

The current rules allow incumbents to occupy valuable spectrum resources for indeterminate periods of time with no requirement or incentive to upgrade to more spectrally-efficient technologies. (see also the answer to #17 above)

20. *What new technologies exist that, if deployed, could improve spectral efficiencies and utilization? What are the barriers to their deployment?*

Many of the radio services authorized by the Commission still employ technologies unchanged or only marginally improved from what was in use at least 2-3 decades ago. Emerging technologies, using digital signal processing, software-defined radios, spectrum sharing etiquettes, interference mitigation techniques, dynamic channel allocation mechanisms, adaptive antennas, and numerous other techniques could result in dramatic increases in spectral efficiency, reducing the need for additional allocations of spectrum for the same services. Mandating reasonable currency with the state of the art in spectral efficiency would reduce or eliminate pressure for new allocations for the expansion of existing services, free up spectrum for new, innovative uses, and increase the possibilities for spectrum sharing.

The history of wireless communications shows a consistent growth in technological sophistication leading to more efficient use of spectrum. Future innovations will likely continue to offer significant improvements. Rather than placing an emphasis on benchmarks based on currently available technology, the focus should be on a flexible regulatory approach that encourages utilization improvements by stakeholders as new technology makes these improvements practical.

21. *Should the Commission consider ways to quantify or benchmark spectral efficiency in a way that permits fair and meaningful comparisons of different radio services, and if so, how would such comparisons be used in formulating spectrum policy?*

Yes, the Commission would greatly advance the public interest by developing such methods. The resulting comparisons could be used to evaluate the public interest value of services desiring spectrum by weighing the public benefit from the service per unit of spectral efficiency.

Spectral efficiency includes at a minimum the following complex components:

1. Utilization of frequency spectrum delimited by modulation and coding parameters (i.e., signal spectral mask).
2. Utilization of 'time on the air', or ratio of on time to off time for a particular system, to share spectrum between systems using different modulation and coding parameters, which is essentially time domain multiple access across different modulation systems.
3. Spatial utilization using adaptive antennas, processing gain, error coding, and other interference mitigation techniques allowing co-located disparate systems to occupy the same frequency segments on a non-interfering basis.
4. Protocol-based sharing etiquettes to support sharing among multiple systems.

The essential issue in "spectral efficiency" is reuse which promotes maximum aggregate utilization of the frequency allocation. Conventional benchmarks of spectral efficiency don't adequately capture the concept of reuse.

a. *How could the Commission define and quantify spectral efficiency?*

The traditional metrics for defining spectral efficiency are limited and do not reflect the true delivery rate of information from a source to a user. The ratio of information bits transported to the amount of spectrum occupied (Bits/Hz) is a metric that is only useful for gauging the performance of modulation and coding schemes. It is more beneficial to have metric which reflects the performance of a wireless system in delivering the data from source to users. The calculation of such a metric would rely on variables that effect the transmission and distribution of information.

Every allocation of radio spectrum bandwidth is ultimately associated with a wireless system or systems that try to utilize that bandwidth most effectively and efficiently. Fundamental to any system, and its most obvious attribute, is its capacity: the ability to deliver a specified amount of unique information per second from its sources to its users. Also important to the wireless system's performance is the coverage area over which the bandwidth (and capacity) is distributed. Incorporation of the concept of coverage area into the proposed metric is necessary as it builds an association of physical location with capacity and bandwidth.

The last factor is the number of logical connections or users. A logical connection or user is a physical point or location to which desired information is ultimately provided. This factor quantifies the number of users of a network associated with the coverage area and the allocated bandwidth.

The Wireless Efficiency ("Weff") metric we propose is expressed by the following equation:

$$Weff=(C \times Ns)/(B \times A) \qquad \text{Bit-Users/m}^2$$

Where:

Weff is the efficiency of the wireless system having units of Bit-Users/m^2

C is the capacity of the system in delivery information bits per second, after decoding, demodulation, and including the vagaries of the network protocol and duty cycle

Ns is the number of logical connections or users in the network, within the coverage area and utilizing the allocated bandwidth B.

B is the allocated bandwidth to the network in Hertz.

A is the area covered (in units of square meters) by the wireless system over which the bandwidth B is uniquely associated.

We would be prepared to submit some representative examples of how the metric could be employed.

b. *How could the Commission meaningfully compare efficiencies across different radio services?*

Adopt the metric outlined above.

c. *Should spectrum efficiency be analyzed subjectively as opposed to quantitatively? If yes, how?*

No.

d. *To what extent should any rules, standards, or guidelines regarding spectral efficiency take into account the relative scarcity of different uses and different geographic areas as well as the cost of spectrum-conserving technologies?*

The metric outlined above addresses this issue. However, Weff may be less important in a practical sense in sparsely-populated areas. As the demographics of an area change over time, the importance of Weff will change. This may result in a need to revisit any geographically-based Weff requirements that may be adopted.

As a practical matter, though, equipment manufacturers will have incentives to design systems with Weffs that meet the needs of densely-populated areas and the resulting economies of scale will likely result in even sparsely-populated areas using equipment that may exceed the sparsely-populated area's needs. This will reduce the likelihood that as the population density grows with time, users would be forced to upgrade their equipment to meet new standards.

e. *What data and other information is necessary for the Commission to evaluate spectral efficiency?*

The parameters outlined in the metric above.

22. *How, if at all, can the Commission provide incentives for operators to use spectrum efficiently? For example, how could to the implementation of fees (e.g., on the basis of Hz per square mile per minute or Hz per population coverage) or receiver standards affect spectrum efficiencies?*

By providing operators economic incentives in the form of more favourable fee structures, where applicable, for systems that achieve higher Weffs.

Public Safety Communications

Public safety and public service agencies at the federal, state and local levels, as well as critical infrastructure industries, require highly reliable radio-based communications services. Like other users of the radio spectrum, the spectrum needs of these specialized users are increasing. We seek comment on how to best preserve and protect the ability of public safety, public service and critical infrastructure entities to do their important jobs in light of the increasing spectrum demands for these and all other services.

23. *What mechanisms can be developed to ensure the availability of dependable, interoperable and cost-efficient radio-based and other Communications services among local and state public safety and federal government agencies in their use of spectrum for public safety, law enforcement, homeland security, and critical infrastructure protection?*

As we are not experts in public safety communicatons systems, we believe that this question is not within our area of expertise/interest.

24. *Recognizing that many of these special needs for communications capacity are highly variable in time and location but generally low in average traffic level, should the Commission and these users consider novel sharing mechanisms for such spectrum that might be appropriate and what criteria (e.g., very high reliability) would need to be used to determine whether such sharing is advisable?*

It is felt that new wireless access terminal technologies, having the capability to actively monitor their electromagnetic environment and quickly reconfigure their emission characteristics, hold the promise of being able to utilize spectrum on an non-interfering basis with incumbent users. Thus spectrum sharing would be possible with the ability to offer prioritized spectrum availability to the incumbent user.

With the advent of extremely powerful signal detection and processing techniques embodied within low cost and intelligent hardware subsystems, there is an opportunity to address sharing concerns and develop new approaches that would preserve existing uses of spectrum while enhancing and broadening spectrum utilizations.

We believe new and promising applications for bands traditionally excluded for consideration can succeed if a regulatory regime is adopted that is open to the benefits offered by new technologies.

25. *How should the amount of spectrum dedicated for the support of public safety and related functions be determined?*

As we are not experts in public safety communicatons systems, we believe that this question is not within our area of expertise.

International Issues

The United States' domestic spectrum allocation and assignment policies exist within the broader context of international spectrum agreements and coordinations, especially with Canada and Mexico. The Task Force seeks comment on the following:

26. *What role should international/global considerations play in spectrum policy in the United States? And conversely, how should U.S. preparations for regional and international meetings on spectrum policy take into account domestic spectrum policy decisions?*

As the United States is part of the Americas and having long borders with two countries as well as many agreements in place with all the Americas, spectrum issues should be considered including effect and affect within these countries. The United States should therefore allow these countries inputs to play as issues for serious consideration in setting the regions' spectrum policies.

Conversely, flexible, progressive domestic spectrum policies should be promoted agressively to the regional and international meetings with a view to achieve as much harmonization as possible globally.

27. *How should the requirements for international coordination of satellite systems affect the U.S. assignment of satellite orbits and frequencies for domestic and international service?*

We do not consider that this body has the expertise to address this question.

28. *Does the International Telecommunications Union (ITU) spectrum allocation process, as codified in the ITU Radio Regulations, facilitate or impede development of domestic spectrum policies?*

Within the ITU-R there is a strong push to try to harmonize spectrum usage. However, as this will take many years to achieve it behoves member countries and regions to move towards the harmonization efforts by use of the footnote allowances to implement development of domestic or regional spectrum policies under appropriate restrictions either in time or usage.

29. *Are there ways in which the Commission can or should improve the coordination process with Canada and Mexico? If so, how?*

The Commission has made great strides over the last few years in coordination with our neighbour countries. More proactive discussions between the administrations at earlier stages of policy development would result in more rapid progess in the coordination process. Obtaining a harmonization of technical restrictions within the three countries especially on "Part 15 unlicensed devices" would be beneficial to all administrations as well as allowing industry and users to benefit from economies of scale.

Respectfully submitted,

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