BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy Task Force	)	ET Docket No. 02-135
Seeks Public Comment On Issues	)	DA 02-1311
Related to Commission's	)	
Spectrum Policies	)	

Chairman, Spectrum Policy Task Force

COMMENTS OF THE U.S. GPS INDUSTRY COUNCIL

The U.S. GPS Industry Council ("Council"), pursuant to the FCC Public Notice released June 6, 2002,[1] hereby offers its comments concerning the Commission's request for public input on possible revisions to existing spectrum policies. The diverse issues broached by the Commission's wide-ranging Public Notice are important ones deserving of careful scrutiny and evaluation. Given the long-term importance of the issues that will be addressed by the Spectrum Policy Task Force ("Task Force") to future technological development and economic growth, the Commission should proceed quickly to identify any significant new proposals for beneficial reform, but should also provide ample opportunity for comment upon and refinement of any substantial changes it ultimately proposes to make as a result of the Task Force's findings.

The June 6, 2002 Public Notice solicits comment on a variety of topics organized under five major topic headings, and presents 28 questions, some of which include additional sub-parts and follow-ups. For the convenience of the Commission and other commenting parties, the Council's comments track these major issue areas and refer specifically to the questions posed. Most of the issues that the Council addresses here relate to the first two topic headings contained

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1 *See* Public Notice, "Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commission's Spectrum Policies," DA 02-1311, released June 6, 2002.

in the Public Notice: Market-Oriented Allocation and Assignment Policies and Interference Protection. The numbered questions in the Public Notice that the Council has not addressed are omitted from this filing. Each question that is discussed herein appears as a single-spaced subheading in bold italics. The Council's responses appear as regular, double-spaced text.

Market-Oriented Allocation and Assignment Policies

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

The radio frequency spectrum today supports a number of decidedly different, but important, industry segments and public purposes. These uses include: radio and television broadcasting; cellular telephony; satellite communications; public safety radio; GPS-based navigation, positioning, and timing; aviation communications; military and civil radar; unlicensed, free-of-charge use; scientific (e.g., radio astronomy); earth sensing, and weather observation. Emerging spectrum uses include short-range local area networks (LANs), as well as mobile Internet applications (such as streaming video). Any change in spectrum management policy must take into account the diverse nature of these well-established service markets. Changes that would disenfranchise or damage these existing markets in the name of promoting promising but untested new services could do tremendous harm to the nation's Information Technology ("IT") infrastructure and to the national and global economy.

The only way of changing the rules and opening up frequency spectrum for the mobile Internet in a manner that does no harm to existing service consumers and service providers is to apply the new rules to the higher and less-well-used regions of the frequency spectrum above 3.1 GHz. Particularly where technology is not well-established in the marketplace, it is appropriate to do initial implementation – the first "real world" testing of product and service viability – in those bands where service growing pains will be felt by far fewer established spectrum users.

The primary role of the FCC should be as the steward of the nation's radio frequency spectrum to ensure its availability for the most important and beneficial uses. Weighing short-term damage against long-term potential must be an important consideration in the decision-making process. When insufficient information exists and operational experience is hard to come by, "first do no harm" should be the primary guideline. This means that any initial experimentation with emerging communication technologies should occur only in the frequency bands with fewer established users. Beyond policy considerations, the technical characteristics of radio frequency propagation above 3.1 GHz lead to limitations in propagation distance, thereby maximizing frequency reuse.

The fundamental difficulty has to do with the untested assumption that unassigned white space spectrum across all bands could be made available for a broad range of unlicensed operations without significant limitations. However, while a significant segment of the spectrum can be used for low power, unlicensed operations, such use has a cost across all bands where it is allowed by continuously increasing the noise floor as disparate users exploit the opportunity. This increase will affect incumbent services overlayed by these white space spectrum allocations.

By choosing only spectrum above 3.1 GHz for this white space allocation, the economic dislocations will be smaller since 96% of the nation's telecom IT engine operates below 3.1 GHz.

It must be recognized that if spectrum is to be licensed for one primary use and then also be made available for an unlicensed overlay use, then the licensed entities will have to contend with an ever-increasing noise floor, unless they are successful at jamming out white space users. Without some mechanism to ensure that unlicensed users operate in a spectrally efficient manner, such an approach could devalue spectrum rights, creating economic uncertainties for existing licensees, and undermining future FCC spectrum licensing processes, including

auctions. Certainly, an approach mandating the licensing of portions of the spectrum for overlays of very wide bandwidth for relatively low power use should be a workable strategy for capping noise floor increases because licensees would be expected to self-regulate as a means of protecting their investments in use of the spectrum.

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?***

Because of the myriad services, licensing rules, and technical characteristics, it is important to establish a common assumption baseline for the national policy debate. Great care must be exercised because unintended consequences could cause real harm to the nation's IT infrastructure. For example, a case could be made that terrestrial broadcast television is a redundant service because the same transmission capability can also be provided by satellite or cable. Such a decision, however, would have a tremendous economic ripple effect across the economy. Nonetheless, from the standpoint of spectrum efficiency alone, such a step would free up a great deal of prime spectrum for other diverse uses.

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

Yes. The lightly utilized upper regions of the radio frequency spectrum allow changes in policy to be made with far fewer negative economic consequences to the nation. In seeking policy mechanisms to reallocate a resource from traditional uses that have developed over time, the concept of eminent domain, as applied to real estate, is a technique that should be considered for possible use in the area of spectrum use. Overlay of spectrum allocated to existing services is, effectively, a government appropriation of established rights and, as a consequence, upsets settled economic expectations of both consumers and service providers. If it becomes necessary to reallocate spectrum to new uses, then the concept of eminent domain should be employed as a means of compensating existing spectrum licensees and users for the loss of expected spectrum use.

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?***

Yes, the lower portion of the spectrum must be treated differently to maintain investment predictability; economic stability; and the integrity of the nation's IT engine. The lower end of the spectrum is allocated and assigned in relatively small, or narrow, bands, thus making it much more difficult to share with high data rate wireless communication services. The inherent fairness and economic stability provided by grandfathering existing systems is a proven methodology for predictable changes to the rules, and ensures investment stability. Experimentation is far more disruptive and expensive to society in the lower portions of the spectrum because there are more systems and people affected.

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?***

Historically, it is easier to find spectrum for development in rural areas because there is less demand for its use. Moreover, conventional radio use in uncrowded spectrum operates over greater distances. Accordingly, spectrum use rules should take into account the distinctions in spectrum availability between congested urban areas and relatively underutilized rural areas. In areas with underutilized spectrum, licensees ought to be able to take advantage of this fact to get greater range out of their existing systems.

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

The noise floor is a good measure of actual use. Measuring trends in noise floor data could be used to generate predictive models.

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* [sic], *and what should the Commission do to address these market failures?***

Licensing for long-term, interference-protected frequency use motivates investment in sustainable infrastructure and sustainable use of the radio frequency spectrum. To the extent that "market-oriented" allocation may be considered to mean an increase in unlicensed, free-of-charge spectrum use, it is important to note that there is no historical example to date of long-term sustainability of spectral utility and underlying value under such fluid conditions. Cross-banding of radio services for public safety use, however, leaving existing services operationally intact, is a positive objective.

On the other hand, destroying current utility and risking public safety by overlaying free spectrum use on existing public safety services would, at best, be destructive and, at worst, lead to critical service disruptions and consequent loss of life. As recent history has demonstrated, the Commission is not in a position to predict market success or failure of any new innovative technology or service. Bold and promising plans often collapse in the face of market realities.

The Commission should not put the existing telecommunications and information infrastructure at risk to provide an opportunity for a novel technology to succeed or fail. The Commission should conduct strategic experiments in specific allocations for unlicensed, free-of-charge operations, or move up in frequency. The Commission should not experiment with wide-band frequency overlays in the heavily used lower portions of spectrum.

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?***

Until a mechanism is established for regulating an increase in the noise floor in unlicensed, free-of-charge frequency bands (e.g., 2.4 GHz consumer bands), it is only a matter of

time before commercial utility is driven out of the band through oversaturation. There are no barriers to entry to a valuable but exhaustible resource. Clearly, it is important to develop incentives so that unlicensed use free-of-charge consumer bands will have sustainable value.

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?***

Before systems proceed from experimental to operational status, there should be localized deployment on a trial basis. Pre-production prototypes should be made available for testing that is realistic for the service that is to be provided. Predictable noise floor modeling needs to be available for wide peer review.

Interference Protection

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

What is really needed is more stringent limits on out-of-band emissions ("OOBE"). The advances in technology make such requirements not only practical, but reasonable.

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

Harmful interference needs to be defined from the standpoint of the spectrum user suffering interference. The FCC, ITU and NTIA definitions suffice. The level of service degradation that can be acceptable for services providing wireless data transmission, for example, is far different from the level of service loss that will be acceptable for vital public safety communications and aeronautical navigation uses.

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

Yes, interference freezes or impedes the market-driven evolution of existing services. As existing services become more spectrally efficient within their allocation, they rely on the spectrum below the noise floor to enhance service reliability or capacity. Where increased

spectral efficiency is driven by user needs, even a one dB rise in the noise floor can damage existing licensees by fundamentally altering assumptions upon which operational efficiencies are based.

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?***

Certainly, power limits are necessary, but "the devil is in the details" of defining the relevant measurements – instantaneous versus average power, and the bandwidth over which the power measurement is made, for example. The right choices depend on the specific situation being analyzed.

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

Defining power limits and implementing other measures to protect against harmful interference can promote innovative technological developments. Operational constraints intended to produce short-term benefits to existing spectrum users can also spur useful and socially positive long-term innovation. For example, prohibiting the dumping of toxic wastes on private property could be considered an economically costly infringement on land use, but such prohibitions promote long-term societal benefits by forcing toxic waste producers to develop means to minimize the production of harmful materials or, at least, to dispose of them safely.

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?***

Yes. Efficient use of the spectrum requires a constant upgrade of the OOBE interference limits. The burden has to be borne by the new entrant technologies, which should be spectrally efficient by their nature. This will initially raise the cost of the new entrant, but the 30% per year decline in costs for electronics will allow them to reach any reasonable price point through innovation. The FCC should not be running a lottery bestowing special benefits upon

proponents of flashy, but unproven, technologies and services. The government does not have to bestow extraordinary spectrum opportunities as a reward for abstract innovation. Truly useful technological advances will produce their own rewards, and absorb their own development and implementation costs, without government incentives. Innovation that does not lead to sustainable growth has questionable societal value.

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?***

Yes. The most significant burdens of good spectrum citizenship must be borne by new entrants that are seeking to alter the status quo. The use of unlicensed equipment for experimentation to establish viable economic models should continue. However, transitioning to widespread deployment outside of experimental assignments should only occur after successful models have been proven. There is no inherent value, and only highly questionable economic benefit to the nation, in overlaying unlicensed free of charge (e.g., 2.4 GHz consumer band) spectrum uses below 3.1 GHz.

In those cases where new entrants cannot co-exist with the original spectrum users, the new entrants should buy out the existing services and reimburse the installed user base, as has been the Commission's past practice. Alternatively, the FCC could exercise eminent domain and reimburse licensees and users in the existing services for losses in service utility caused by an unlicensed overlay.

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?***

No. As a market facilitator, the Commission would be put in the untenable position of picking winners and losers by deciding how much receiver manufacturer A should increase its costs so that transmitter manufacturer B can lower the price point for its devices. Thus, imposing receiver design requirements would effectively involve the adjudication of which

entities would increase expenditures in order to achieve government-mandated results, and thus would operate as a hidden redistributive tax on affected industries. The consumer would bear the ultimate costs without having any voice in the decision.

The definition of robustness must include a definition of, and preservation of, the noise floor. Manufacturers must be permitted to design and field more robust receivers by utilizing the spectrum below the noise floor. Manufacturers that are doing this *should not* be burdened by overlays that increase the noise floor.

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

The Commission should consider benefits to society gained from using spectrum below the noise floor. In the case of GPS, the utility of spectrum below the noise floor is accounted for in the design of GPS receivers to operate indoors and meet the requirements for mobile E911 location. The evolution of this enhanced sensitivity receiver technology to benefit a broad range of existing GPS users for other outdoor applications in congested environments rewards GPS spectral efficiency.

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

The Commission should minimize the areas of conflict by concentrating on spectrum above 3.1 GHz. This is where the majority of the frequency spectrum lies. This will allow the new entrants to invest and reduce the cost of their innovation.

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

Every spectrum case is different, so one size is unlikely to fit all circumstances.

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?***

Each one of these techniques can play a useful role. Negotiation would be appropriate in circumstances where a new entrant desires to buy an existing stakeholder's interest. Mediation,

arbitration, and case-by-case adjudication would be appropriate in the case of a damaged party seeking recovery for damages for out-of-band emissions.

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?***

Adopting an approach that would attempt to base interference regulation on economics would place the Commission in the unworkable position of determining winners and losers among stakeholders; some of which have actual economic value, and others of which have only projected economic value. The ability of any governmental entity to make predictive judgments in such circumstances is highly questionable. While technical expertise is a necessary element, it is not sufficient to compete the required analysis, and it is far from certain that such analysis is an appropriate governmental function. The Commission should not attempt to set industrial policies that have the effect of anointing particular winners and losers. The experience of venture capital funds has demonstrated that there are many more promising ideas than economic successes.

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

The measure of spectral efficiency in any given service is defined by Claude Shannon's formula for the capacity of a band-limited channel. Using this standard measure, GPS is very spectrally efficient because the satellite is a 400-Watt transmitter over 10,000 miles from the Earth's surface. The user segment is operating well below the noise floor.

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

There are stealth communication technologies that are clearly not spectrally efficient. On the other hand, because they are stealth, they are sparsely used and are not detected by primary spectrum users; therefore, they do not pose a problem to the Commission and its constituents.

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

There are ultra-wideband modulation techniques that are spectrally efficient. When operating in an unlicensed band, there is a commercial motivation to use these spectrally efficient techniques because devices based on them will be the last to lose their commercial utility in the band. Sustaining the overall commercial utility requires management of the noise floor through some mechanism of regulation – either self-regulation or some other means.

20. ***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?***

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

Spectral inefficiency can be quantified as the deviation from Shannon's theoretical performance – within a given bandwidth, the data rate as a function of the signal-to-noise ratio. For example, the last mile Internet problem is a high data rate, short transmission distance problem. GPS is a low data rate, 20,000 km distance problem. One must determine how much the signal-to-noise ratio being raised in the channel because this affects the amount of data that can be transmitted.

Respectfully submitted,
THE U.S. GPS INDUSTRY COUNCIL

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