
Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of)
)
The Commission's Spectrum Policies) ET Docket No. 02-135
)

To: Spectrum Policy Task Force

COMMENTS OF CINGULAR WIRELESS LLC

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TABLE OF CONTENTS

SUMMARY	ii
INTRODUCTION	1
DISCUSSION.....	5
I. THE SPECTRUM MANAGEMENT PARADOX.....	5
A. Exclusive Licenses with Flexibility.....	6
B. Shared Spectrum Access.....	11
C. Command-and-Control Allocation and Licensing	14
D. Overlays and Underlays.....	14
II. SOLUTION TO THE PARADOX	16
A. The Preferred Spectrum Management Model Is Market-Oriented, Relying on Exclusive, Flexible, Well-Defined Licenses Protected from Interference.....	17
B. Establish Four Broad Usage-Based Categories For Determining Initial Allocation and Licensing Criteria.....	20
C. Licensees Should Be Granted Considerable, But Not Unlimited, Flexibility	21
D. Licensees Should Have the Right to Lease Spectrum to Others	24
E. Clear and Unambiguous Definition of the Spectrum User’s Rights and Responsibilities Is Essential to Market-Based Spectrum Management Relying on Auctions	26
III. ISSUES RELATING TO INCUMBENT LICENSEES.....	31
A. Secondary Market Leasing Should Be Allowed	31
B. Geographic-Area Overlays.....	31
C. Service Areas for Point-to-Point Service	33
D. Flexibility Rules	34
E. Treatment of Exclusive Licensee Incumbents Who Are Licensed Site-by- Site	34
IV. GENERAL SPECTRUM POLICY ISSUES.....	36
A. The Need for Further Information on Noise Floors, Operating Conditions	37
B. Definition of “Harmful Interference”	40
C. Interference Protection Burdens	47
D. Uniformity of Spectrum Policy	48
E. Measurement/Prediction of Spectrum Use, Congestion, and Demand.....	49
F. Unlicensed Radio Services.....	50
G. Facilitation of Experimentation and Innovation.....	51
H. Receiver Standards for Establishing Interference	52

SUMMARY

The Spectrum Policy Task Force has asked for comment on the approach that should be taken to spectrum management. The review herein focuses on how best to meet the increased demand for wireless services and increase the efficient use of scarce spectrum.

The preferred spectrum management model is market-oriented, relying on exclusive, flexible, and well-defined licenses. Four broad usage-based categories for determining initial allocation and licensing criteria should be adopted, as follows: (1) point-to-point; (2) satellite/airborne; (3) broadcast; and (4) point-to-multipoint/mobile. These categories would allow establishment of a baseline for determining the nature of, and service rules governing, the spectrum allocation. At the same time, the Commission should grant licensees flexibility and property-like rights regarding how their spectrum is used, consistent with the baseline category.

This approach would advance bedrock goals of the Commission by:

- Allowing market forces, within broad limits, to determine the highest and best use of spectrum;
- Protecting against harmful interference without having to police it on a case-by-case basis in a complex shared-use, multiple-service, environment;
- Ensuring the achievement of FCC mandates;
- Protecting public safety and homeland security by helping to ensure safety-related communications systems have access to dedicated public safety spectrum, while allowing commercial services to complement public safety agencies by providing reliable services such as E-911 using their own exclusive spectrum allocations; and
- Providing certainty as to the rights that are being auctioned, thereby protecting the market-based spectrum management system and encouraging involvement by applicants, equipment manufacturers, and the financial community.

The shared spectrum model is clearly disadvantageous from an interference standpoint. It would require the Commission to define parameters for inter- and intra-service, and inter- and intra-technology, interference measurement and protection in a variety of environments while technology is changing dramatically.

With each new service packed into a band, the noise floor in different environments would have to be measured. Moreover, for each band potentially affected, co-channel, adjacent-channel, and even out-of-band interference studies would have to be performed for each existing service (using both preexisting technologies and those whose introduction can be reasonably foreseen). The probability of harmful interference also would have to be predicted for each existing service. In addition, the Commission would have to consider the cumulative effects of multiple sources of interference. Exclusive flexible allocations are not nearly so complex and unpredictable.

Numerous other issues are addressed as well.

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Cingular Wireless LLC (“Cingular”), by its attorneys, hereby submits its comments in response to the June 6 Public Notice released by the Spectrum Policy Task Force.¹

INTRODUCTION

The development and consistent application of spectrum policies that further the public interest have always been core functions of the Commission. One of the central reasons why Congress created the Commission and its predecessor, the Federal Radio Commission, was to end the interference that resulted from a free-for-all of unregulated, uncoordinated spectrum usage.²

The present examination of spectrum policy is extraordinarily broad in scope, touching upon virtually every aspect of spectrum usage. Given the reliance of the public — and the telecommunications industry that serves it — on prudent employment of spectrum, this Task Force’s job is a challenging one; it addresses one of the Commission’s essential responsibilities. Spec-

¹ Public Notice, *Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commission’s Spectrum Policies*, ET Docket 02-135, DA 02-1311 (June 6, 2002) (“Notice”).

² See generally Glen O. Robinson, *Title I — The Federal Communications Act: An Essay on Origins and Regulatory Purpose*, in Max D. Paglin, ed., *A LEGISLATIVE HISTORY OF THE COMMUNICATIONS ACT OF 1934 (LEGISLATIVE HISTORY)* 3, 8-11(1989); J. Roger Wollenberg, *Title III — The FCC as Arbiter of “The Public Interest, Convenience, and Necessity,”* in *LEGISLATIVE HISTORY* at 61, 61-70; *National Broadcasting Co. v. United States*, 319 U.S. 190, 212 (1943) (“With everybody on the air, nobody could be heard.”).

trum policy needs to be reexamined in light of the public's increased demand for wireless services. This increased demand requires the Commission to "allow[] spectrum markets to become more efficient and increas[e] the amount of spectrum available for use."³

The Notice provides a good first step in moving the Commission towards developing long-term spectrum management plans and policies. The CMRS industry also needs additional spectrum allocated to it over the next decade. As Wireless Telecommunications Bureau Chief Thomas J. Sugrue observed recently, "The simple truth is that as our society grows increasingly dependent on wireless technology and services, spectrum demand is stressing the supply, and that has made spectrum management difficult for government."⁴ Accordingly, the outcome of this Notice should be combined with other spectrum initiatives, such as the allocation of spectrum for advanced wireless services, in developing long-term management plans and policies. Allocation and assignment principles, interference protection, spectrum efficiency, public safety communications, and international issues — the items teed up in the Notice — cannot be viewed in isolation; they are, at this elemental level, interdependent.

The Commission and its staff have expended considerable effort over the years to address difficult spectrum management issues brought on by new technologies, services, and public demand. Here, the Commission, as part of its analysis, should continue to defer to the marketplace to the extent possible; a prime objective of spectrum management should be a policy that it is responsive to public needs through market forces.

³ *Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, Policy Statement*, 15 F.C.C.R. 24178, ¶ 18 (2000) (*Secondary Markets Policy Statement*).

⁴ Jube Shiver, Jr., *FCC Steps Up Airwaves Hunt*, Los Angeles Times, July 5, 2002, at Business page 1.

The Task Force's report and subsequent Commission spectrum management actions depend on having sufficient technical and engineering expertise available to evaluate increasingly complex and sophisticated telecommunications techniques and their interactions with the existing radio communications environment. The Commission needs to ensure that its staff's expertise continues to keep pace with technological advances. The Commission's efforts to increase its technical staff and to expand the expertise of its engineers are steps in the right direction, and its commitment to continue this process and to develop fully the human expertise needed to deal with the issues before it is essential.⁵

To date, the Commission has attempted to manage spectrum on a case-by-case basis. Continuation of that approach will require the Commission to define and rectify harmful interference in increasingly difficult settings. Absent constant vigilance over harmful interference, the availability of core services will be diminished through increases in the noise floor.

As discussed herein, auctions of exclusive allocations are preferable to shared spectrum access, in general. Exclusive allocations facilitate interference prevention and avoid the need to engage in complex proceedings to analyze and define harmful interference between diverse services sharing frequencies. A market-based system such as auctions, however, will work properly only if there is certainty and clarity *in advance* concerning the rights and responsibilities of licensees. The FCC must also stand by such principles *after* the auction to assure an orderly market. The exclusive allocations should include a reasonable degree of licensee flexibility. The marketplace forces that are unleashed under an exclusive flexible allocation regime give licensees incentives to use spectrum more efficiently, accommodate new technology, and adapt to public needs for new and improved service. Moreover, exclusive flexible allocations are better than

⁵ See *Draft Text for the FCC's Strategic Plan, 2003-2008*, <<http://www.fcc.gov/omd/strategicplan/strategicplan2003-2008.pdf>>, at 10, 17 (July 1, 2002) ("Strategic Plan").

shared allocations in meeting certain Commission goals; they further public interest objectives such as readily available communications for public safety and homeland security as well as reliable E911 service.

In any spectrum allocation proceeding, the Commission, at the outset, should make a determination regarding the broad category of use for such allocation; it should not simply fall back on unfettered flexible use. The broad categories should be: point-to-point, satellite/airborne, broadcast, and point-to-multipoint/mobile.⁶ Each exclusive license resulting from such allocations should have considerable flexibility *within its respective category*. Flexibility within each category, instead of total flexibility, is essential to foster a viable CPE market, diminish the complexity of addressing inter-service and inter-category interference issues, and accomplish elemental Commission public interest objectives.

The Task Force should be guided in this proceeding by the recent words of Commissioner Abernathy:

So let me begin with perhaps the most significant responsibility government has — to craft and enforce rules that prevent harmful interference to our licensees. Government, for the most part, has done a reasonably good job as the interference police. But this job becomes more complex by the day — and the recent public safety interference problems illustrate the challenges we face going forward.

...

Once the Commission has stepped up to serve as “interference police” I believe our role should be to maximize the flexibility afforded to current licensees. Artificially limiting flexibility through government fiat does not assist anyone — in fact, it essentially results in government holding onto rights it cannot use and artificially limiting the spectrum market.

...

Ultimately we rely on the personal interests in spectrum-based businesses to drive new products and services to consumers. In fact, I believe our goal of advancing the public interest is most ef-

⁶ The need for the four categories is discussed at greater length in Section II.B, below.

fectively achieved when we harness the energy and drive of private interests in pursuit of those public goals. . . .⁷

DISCUSSION

I. THE SPECTRUM MANAGEMENT PARADOX

The Task Force faces the difficult task of addressing and proposing how to either reconcile or choose from several very different approaches to spectrum management. Traditionally, the Commission designated block allocations for specific uses, by means of administrative “command-and-control”⁸ spectrum assignments, rulemakings, and license restrictions. This command-and-control model has, for the most part, outlived its usefulness. Today, the Commission needs to manage spectrum in ways that facilitate the provision of new services and the deployment of new technologies for the benefit of the public.

Looking toward future allocations, there are two general approaches that address this obligation. The first is the allocation of spectrum for exclusive licenses coupled with flexible rules⁹ that allow market forces to work. The alternative under consideration is shared spectrum allocations, under which new uses of spectrum are euphemistically “overlaid” or “underlaid” on existing uses.¹⁰

⁷ Remarks of Commission Kathleen Q. Abernathy before the National Spectrum Managers Association, at 2, 4 (May 21, 2002) (as prepared for delivery).

⁸ Pablo Spiller and Carlo Cardilli, *Toward a Property Rights Approach to Communications Spectrum*, 16 YALE J. ON REG. 53, 57 (1999).

⁹ In general, service flexibility should be defined prior to auction, not afterward (*i.e.*, retroactively), as more fully discussed in Section II.E, below.

¹⁰ See generally Thomas W. Hazlett, *The Wireless Craze, the Unlimited Bandwidth Myth, the Spectrum Auction Faux Pas, and the Punchline to Ronald Coase’s “Big Joke”: An Essay on Airwave Allocation Policy*, 14 HARV. J. LAW & TECH. 335 (2001) (*Hazlett Essay*); Thomas W. Hazlett, *Eli Noam’s Proposal for “Open Access” to Radio Waves*, 41 J. LAW & ECON. 805 (1998) (*Hazlett Open Access Rebuttal*); see also Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment*, 11 HARV. J. LAW & TECH. 287 (1998); Spiller and Cardilli at 68-72.

These models are mutually exclusive. If the Commission believes that market forces will best serve the public interest by moving toward the highest and best use of spectrum, then it should grant licenses that are akin to property rights and refrain from imposing any but the most essential restrictions on spectrum usage.¹¹ This is the direction the Commission has gone, to some degree, in PCS. Conversely, if new entrants are given shared access to already-occupied spectrum for the deployment of new technologies, then incumbent licensees will be inhibited from acting in accordance with market forces. Moreover, such an approach could lead to a “tragedy of the commons”¹² in which shared spectrum access leads to destructive interference and less effective, and possibly detrimental, use of the spectrum.¹³ In addition, when the Commission imposes limitations on the ability of licensees to use their assigned spectrum beyond those necessary to prevent interference, it substitutes its own judgment for that of the marketplace, diminishes consumer welfare, and places obstacles in the way of innovation.¹⁴

A. Exclusive Licenses with Flexibility

The Commission should, except in rare circumstances, allocate blocks of spectrum, harmonized to the greatest extent possible with international allocations. Within these blocks it should grant exclusive licenses and then rely on market forces to tailor spectrum use to public

¹¹ See, e.g., *Hazlett Essay* at 532, 533, 566-67; Gregory L. Rosston and Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 50 COMM. L.J. 87, 93-102 (1997).

¹² See generally Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

¹³ See, e.g., *Hazlett Essay* at 373-78; *Hazlett Open Access Rebuttal* at 815 (“While many . . . are impressed by the technical agility of “spread spectrum” and other techniques to squeeze much more electronic communications out of any given bandwidth, it is simply not true that the tragedy of the commons has been solved by science.”).

¹⁴ See Spiller and Cardilli at 59-62; Benkler at 315-21, *citing* Leo Herzel, “*Public Interest and the Market in Color Television Regulation*,” 18 U. CHI. L. REV. 802 (1951), Ronald Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959).

demands. The limitations on a central body's ability to optimize spectrum usage through administrative means are well understood:

In general, the public derives the greatest benefit from spectrum when the spectrum is used for services that the public values most highly and therefore is most willing to pay for. No government agency, however, can reliably predict public demand for specific services or the future direction of new technologies. Even if technology and the public's needs were unchanging, a central planner could only imprecisely evaluate the benefits of the myriad possible uses of spectrum and determine which frequencies should be used for each service. Given the rapid evolution of technology, moreover, the Commission cannot reliably predict what services will be available or which frequency range will be efficient for any service even a few years from now, much less what the public demand for each service will be and how to respond to changing demand. Therefore, even if the Commission could correctly identify the most economically efficient use of spectrum at any given time, it would be obliged continually to modify its allocations to reflect technological and economic developments. This reallocation process necessarily consumes substantial public and private resources, reduces certainty for users of spectrum, discourages investment, and delays the introduction of new services. This process also discourages innovation¹⁵

Because of these shortcomings, the Commission has increasingly relied on market forces to ensure efficient use of spectrum. It has accomplished this by granting initial licenses that confer interference-protected exclusive spectrum usage rights within a defined service area, coupled with considerable licensee flexibility. The exclusive nature of these licenses is well established by the Commission's rules and decisions.¹⁶

¹⁵ Rosston and Steinberg at 92-93.

¹⁶ For example, cellular licensees' exclusive rights are guaranteed by rule, *see* 47 C.F.R. § 22.905(a), and the Commission has repeatedly described a PCS licensee as having the same kind of exclusive use of its frequency band within its service area. *See New Personal Communications Services*, GN Docket 90-314, *Memorandum Opinion and Order*, 9 F.C.C.R. 7805, 7809 (1994) ("one [PCS] license per spectrum block per service area"); *Regulatory Treatment of Mobile Services*, GN Docket 93-252, *Third Report and Order*, 9 F.C.C.R. 7988, 8042 (1994) (one of the four elements upon which the Commission's "licensing rules for PCS and cellular are based" is the "assignment of contiguous spectrum blocks to a single license on an *exclusive* basis") (em-

(continued on next page)

1. License Exclusivity

Exclusive licensing is critical to a market-oriented spectrum management scheme for several reasons. First, the competitive bidding process is intended to ensure that the spectrum goes to the party with the highest and best use for it, but only if the spectrum license at issue is an exclusive license. Section 309(j) auctions are only applicable when “mutually exclusive” applications are filed for a license.¹⁷ Congress specifically intended auctioned licenses to be exclusive. It declared that “*every exclusive license granted denies someone else the use of that spectrum,*” and that exclusivity is “*what give[s] spectrum a market value*” in an auction and thus provides the licensee an incentive to use it “productively and efficiently.”¹⁸

In fact, there would be little point in auctioning licenses for spectrum from which other users are not excluded. Without a protected, unique interest in the use of a block of spectrum, a licensee would be less able to gauge the spectrum’s capacity and value and would therefore be less willing to invest in the facilities needed to make efficient and productive use of it.

In short, a license that lacks exclusivity does not facilitate market-based spectrum management. A nonexclusive license is not akin to a property right, which is essential to a market-based model:

Property rights allow markets to allocate resources. Band owners striving to maximize values compete to supply users, investing in technology to improve operations and innovating in business mod-

(footnote continued)

phasis added); 9 F.C.C.R. 2863, 2877 (1994) (both PCS and cellular are “services where licensees have *exclusive* channel assignments over large service areas”); *Competitive Bidding 800 MHz SMR*, PR Docket 93-144, *Further Notice of Proposed Rulemaking*, 10 F.C.C.R. 7970, 7995 (1994) (“a licensee has exclusive use of a block of contiguous channels . . . in cellular or PCS”); *Public Utility Commission of Texas*, 13 F.C.C.R. 3460, 3503 (1997) (PCS and cellular licensees receive “an exclusive right to use a designated portion of the electromagnetic spectrum for the term of the license”).

¹⁷ 47 U.S.C. § 309(j)(1).

¹⁸ H.R. Rep. No. 103-111, at 249 (1993), 1993 U.S.C.C.A.N. 378, 576 (emphasis added).

els, network architectures, and consumer applications to encourage new traffic. When free to do so, entrepreneurs eagerly mix and match systems, technologies, and frequencies, iterating on efficient solutions. Competitive markets discover low-cost ways to provide high-value services.¹⁹

The exclusivity of a license and its value at auction depend on a careful definition of the interference protection to which the licensee is entitled from other spectrum users, as well as the power levels that the system is allowed to employ at the boundaries of its service area (which, in turn, is dependent on the interference protection to which an adjacent licensee is entitled). As discussed below, setting these criteria depends on certain technology assumptions and becomes more difficult when licensees are granted too much flexibility.

2. Flexibility

Among the categories of flexibility that have been granted to one degree or another are: (1) service flexibility (*i.e.*, the ability to use spectrum for services of the licensee's choice), (2) technical flexibility (*i.e.*, the ability to use equipment and technology of the licensee's choice, and to deploy facilities without site-by-site authorization), (3) spectrum and service area flexibility (*i.e.*, the ability to engage in geographic partitioning or consolidation and spectrum disaggregation or aggregation), and (4) implementation flexibility (*i.e.*, the ability to build out a network without construction or coverage requirements and deadlines).²⁰ In addition, the Commission is considering an additional level of flexibility that would be directly responsive to market forces: the ability to sell or lease spectrum usage rights on the secondary market.²¹ Flexibility should

¹⁹ *Hazlett Essay* at 566.

²⁰ *Id.* at 100-01.

²¹ See *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, WT Docket 00-230, Notice of Proposed Rulemaking, 15 F.C.C.R. 24203 (2000) (*Secondary Markets NPRM*).

not be boundless, however. It should be related to the broad category to which the spectrum is initially allocated.

It is important to distinguish between prospective and retroactive grants of flexibility, especially with respect to service flexibility. Absent the most compelling reasons, service flexibility in the context of a future allocation should be determined prior to such allocation. The degree of service flexibility must be known at the time of auction because it defines the licenses and thereby permits potential bidders to evaluate the licenses in light of the degree of flexibility afforded. Granting service flexibility *after* auction, on the other hand, should be avoided, because it changes the nature of what was auctioned and will remove certainty as to the auction process.

Based on the foregoing, if an auction winner's business plan fails, then the Commission should allow the licensee to fail. After-auction flexibility should not be used to remediate failed business plans. It rewards speculative bidding to the detriment of the public interest.²²

Retroactive grants of service flexibility will not ensure that spectrum licenses will go to those who have the highest and best use for the licenses actually auctioned. Rather, such grants may cause the licenses to go to those who believe they can obtain flexibility changes after the auction that will increase the licenses' value. Moreover, granting flexibility after licensing can balkanize the spectrum by encouraging incumbents to seek alternative uses in the short run, thereby using the spectrum inefficiently, and making it more difficult for the spectrum to be reconstituted into adequate and commercially reasonable amounts.

²² See, e.g., *Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services (PCS) Licensees*, WT Docket 97-82, *Order on Reconsideration*, 16 F.C.C.R. 1343, ¶25 (2001) (elimination of designated entity transfer restrictions retroactively would constitute a "windfall" and be contrary to the public interest); see also *Goodman/Chan, Memorandum Opinion and Order and Order on Reconsideration*, 13 F.C.C.R. 21,944, ¶ 48 (1998) (granting retroactive rule change would "encourage speculative activity or invite abuse of our processes.").

Unlike service flexibility, the other forms of flexibility do not affect the nature of the licenses being auctioned. Bidders recognize that the Commission often grants licensees additional flexibility with respect to technology, service areas, spectrum blocks, and so on. As a result, the integrity of market-based spectrum management and the auction process is not impugned by granting licensees additional flexibility in these areas after auction.

B. Shared Spectrum Access

The chief alternative to exclusive licenses is to afford multiple users (licensed or unlicensed) shared access to common spectrum.²³ This spectrum management scenario is much more difficult to accomplish, due to the need to establish hierarchies as to which users are entitled to interference protection from others. This hierarchical approach is inherently contrary to market-based spectrum management principles, because it requires the Commission, not market forces, to rank the uses and users of spectrum in a political exercise of “picking winners and losers.” If the Commission does not provide and enforce such interference criteria, then chaos is sure to result, as it did with CB radio in the 1970s.

Under the alternative, the Commission must determine the level of interference protection to which each primary or secondary user is entitled vis-à-vis each other user. This requires, again, administrative judgments about the current state of the art in various technologies and services and picking winners and losers based on their presumed values to the public and their ability to withstand particular types and levels of interference.

These judgments are especially difficult and subjective when there are significant technological differences among the various uses of the shared spectrum. For example, fixed and mobile services have different characteristics; as do terrestrial and satellite services. Even within

²³ In general, unlicensed shared use should occur on bands of spectrum separate from those used for licensed services entitled to interference protection, as discussed in Section IV.F, below.

a single class of users, there may be a wide variety of technologies and services involved, which is especially likely when one or more users have technological flexibility. CMRS licensees, for example, commonly use analog AMPS technology and four different digital technologies (TDMA, CDMA, GSM, and iDEN). Additional, more advanced, “2.5G” and “3G” digital technologies have already been introduced or will be soon (*e.g.*, GPRS, EDGE, 1xRTT, w-CDMA). The bandwidths employed today in CMRS systems range from 25 kHz to 1.25 MHz, and some of the technologies being introduced utilize even broader bandwidths.

Just *evaluating the potential* for interference among different services employing diverse technologies *today* would require the Commission to consider how each type of service and technology would affect each other type of service and technology. This requires data concerning transmitter, receiver, and other operating characteristics for each type of use — data that may be unavailable even for widely deployed services and technologies,²⁴ and is subject to dynamic change as a result of advancing technology. It also requires, for each type of interaction, development of theoretical interference models and analysis of the results of those models, because there is no universally applicable way of evaluating interference among different signal types. It also requires controlled and real-world tests. Even where the multiple uses are technologically similar, evaluation of interference potential and establishment of protection criteria requires extensive testing and analysis.²⁵

²⁴ For example, in the Ultrawideband proceeding, the Commission based its analysis of interference with PCS on a staff report that acknowledged the FCC did not know the “minimum signal level that is expected to be received by a PCS handset” and did not “have any data regarding the actual signal levels employed in PCS systems.” FCC Staff Report, ET Docket 98-153, “Potential Interference to PCS from UWB Transmitters Based on Analyses by Qualcomm Incorporated,” at 4 (dated Feb. 14, 2002, filed May 3, 2002).

²⁵ See, *e.g.*, *Creation of Low Power Radio Service*, MM Docket 99-25, *Report and Order*, 15 F.C.C.R. 2205, *recon. in part, Memorandum Opinion and Order on Reconsideration*, 15 F.C.C.R. 19,208 (2000).

The interference evaluation cannot consider only existing spectrum uses. Basing a determination that a new use will not interfere with licensed services only on a snapshot of today's (or yesterday's) technology ignores the fact that licensees rely on the technical and service flexibility that the Commission has granted them. New services and technologies are continually being developed and tested prior to introduction in accordance with flexible use rules and often result in more efficient use of spectrum. In light of these rules, it is illogical and arbitrary to base an interference determination on a technological freeze-frame instead of taking into account the dynamic state of the art. Any evaluation of the effects of a new spectrum use on existing licensees needs to address the reasonably foreseeable uses of that spectrum by existing classes of licensees under the applicable flexibility rules. This is obviously very difficult to assess, but it is necessary to protect the flexibility the Commission has granted licensees.

Spectrum sharing poses an additional level of complexity that is largely inapplicable to exclusive allocations, because the differing uses will typically overlap in geographical scope. Transmitters employed by new (shared) spectrum users may be located very close to transmitters or receivers employed by existing licensees. As a result, the Commission must reach judgments as to the permissible signal level for each transmitter, not simply the signal level at the boundary between co-channel licensees, as with exclusive licenses. This, in turn, requires the Commission to consider how close the new transmitters may potentially be located to the transmitters or receivers of the existing services before they cause harmful interference — distances that may be as small as feet or even inches, as in the Ultrawideband proceeding.²⁶

²⁶ Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, ET Docket 98-153, *First Report and Order*, FCC 02-48 ¶¶ 155, 156, 161 (April 22, 2002) (*UWB Order*) (discussing interference measurements at separation distances as low as 0.3 meters).

In addition, shared access to spectrum can occur in very different scenarios, which may require different types of analysis and, undoubtedly, different forms of interference protection. In some cases, the Commission may be considering granting a class of stations or devices (licensed or unlicensed) access to a band of spectrum that is either little-used or unused by others entitled to interference protection. There it needs only to establish criteria appropriate to the single class of stations or devices. In other cases, the Commission may be considering granting access to one or more bands of spectrum already heavily used by others who will be entitled to interference protection. In such cases, the Commission would have to consider each affected spectrum band and application to arrive at appropriate interference protection criteria. Another scenario is where a new use is under consideration for spectrum already held by an exclusive licensee that is limited to a particular type of use. In those cases, the Commission not only has to consider whether the two uses will interfere with each other, but also whether they can or should be provided by the incumbent licensee or auctioned to new licensees.

C. Command-and-Control Allocation and Licensing

There may still be a very few circumstances where the Commission needs to consider using traditional service-based allocation and licensing. Under this model, the Commission prescribes in detail what the spectrum may be used for, the technical characteristics of usage, and other factors, such as construction schedules. Because this mode of spectrum management allows little room for responsiveness to public needs, the presumption should be strongly against its application.

D. Overlays and Underlays

The Notice asks a number of questions regarding “overlays,” which is an unfortunate term, because it can be used to refer to at least three different scenarios. One form of overlay is when the Commission authorizes a new user of a block of spectrum in a geographic area where

that spectrum is already in use by one or more incumbents, with a procedure for relocating the incumbents over time, such as when PCS was authorized.²⁷ This is, in essence, a form of shared spectrum access for a temporary transition period, after which it becomes an exclusively licensed arrangement.

A second type of overlay occurs when a new licensee is granted a geographic territory surrounding, but not including, the incumbent's service area, as when geographic SMR licenses were auctioned for territory not covered by existing facilities. This is more properly referred to as a "geographic-area overlay," to distinguish it from the "overlay" discussed above.²⁸ This does not result in multiple licensees in a given areas and is not a form of shared spectrum access; instead, it results in geographically distinct exclusive licenses.

Yet a third type of overlay occurs when a new use is authorized that overlaps existing usage and is *intended* to coexist with it on a noninterfering basis, which is what the Commission intended to accomplish with Ultrawideband service. Hazlett refers to this as an "underlay,"²⁹ and we will use that term to avoid confusion (even though a particular "underlay" service could cause interference to existing uses). An "underlay" is a form of shared spectrum access. The Commission's Ultrawideband rulemaking decision illustrates the complexity of assessing the

²⁷ See Rosston and Steinberg at 112 & n.80 ("An 'overlay' is a second assignment of already licensed spectrum, pursuant to which the overlay licensee must secure the original licensee's agreement either to vacate the spectrum or to accept interference before it may begin operations."); see also *Hazlett Essay* at 513-14 & n.558 ("'Overlay rights' are a variant of an old spectrum allocation institution. For decades, bands have been assigned for use by 'primary' and 'secondary' users. Overlay rights are similar to being assigned 'secondary' status, although the ability of these secondary licensees to negotiate and buy-out primary users was an important innovation.").

²⁸ See Rosston and Steinberg at 94.

²⁹ See *Hazlett Essay* at 509, 550.

likelihood of interference, and adopting rules to prevent harmful interference, when a new un-
derlay spectrum use is to share spectrum that is already in use.³⁰

II. SOLUTION TO THE PARADOX

Choosing among these approaches³¹ is difficult, because no single approach solves all of
the problems faced by the Commission as spectrum manager. The Commission should follow a
policy that primarily employs the exclusive licensing approach, but recognizes that the appropri-
ate spectrum management model will ultimately depend on the expected use and technological
characteristics of the spectrum bands at issue.

No single spectrum management model will allow the Commission to meet all of its re-
sponsibilities in every band. The best model *in general* will be to grant exclusive flexible li-
censes that allow market forces to drive how public demand will be met and provide for new
services and technologies. Over the last two decades, the Commission has placed considerable
reliance on market forces with regard to many aspects of spectrum policy. By and large, this has
been beneficial, because markets can respond to the public's need for communications services
by matching supply to demand.

The marketplace works most effectively under a system of exclusive licenses because the
rights of the licensee are clearly understood. The licensee has the exclusive right to use its as-

³⁰ See *UWB Order*. As several petitions for reconsideration have pointed out, the Commis-
sion did not adequately address the need for interference protection. See, e.g., Cingular Wireless
LLC Petition for Reconsideration, ET Docket 98-153, at 10-16 (June 17, 2002).

³¹ The Commission does not have complete freedom of action, because it must take into
account government spectrum use that is outside its control and must follow an approach that
comports with both governing law, including the Communications Act and the Administrative
Procedure Act, and international radio regulations and treaties. Accordingly, the Commission
need not consider purely theoretical proposals, such as to grant outright spectrum ownership in-
stead of licenses, or to hold one grand auction of all spectrum (government and non-govern-
ment), as suggested by some academics. See, e.g., Spiller and Cardilli at 81-83; *Economist
Urges Market-Driven Plan*, 68 Telecomm. R. No. 21, at 9 (May 27, 2002) (describing proposal
by Gerald Faulhaber).

signed spectrum within a specified geographic area. This clarity increases auction value and facilitates the creation of secondary markets. Exclusivity also promotes new technologies and efficiencies. If a licensee has exclusive access to the spectrum, then it is more likely to employ the spectrum efficiently because it will not “lose” spectrum to another party sharing the band. Exclusive use also makes it easier to comply with public interest mandates, such as the provision of E-911 services.

Accordingly, a critical role for the Commission is determining when spectrum management can best be left to markets, through flexible exclusive licensing, and when externalities, such as market failure or other extraordinary factors, require a different approach. For example, there are a limited number of situations where shared spectrum use is more appropriate than a market-based approach. Any sharing should occur in separate bands of spectrum, however, to avoid interfering with the ability of exclusively licensed spectrum users to respond to the marketplace. There may also be some situations where more traditional administrative control of spectrum use is appropriate, due to international concerns, government spectrum use, or other factors.

A. The Preferred Spectrum Management Model Is Market-Oriented, Relying on Exclusive, Flexible, Well-Defined Licenses Protected from Interference

When possible, the Commission should utilize the exclusive flexible licensing approach, rather than shared access or traditional allocation and regulation, because this is most consistent with the Commission’s spectrum management objective of allowing market forces to determine the highest and best use of spectrum. The Commission has recognized that “the following principles concerning licensee rights and responsibilities” are consistent with its spectrum management obligations:

- “Licensees should generally have clearly defined rights to their spectrum, including frequency bands, service areas, and license terms of sufficient length, with reasonable renewal expectancy, to encourage investment;”
- “Licensees and spectrum usage rights should be easily transferable for lease or sale, divisible, or aggregatable;”
- “Licensees/users should have flexibility in determining the services to be provided and the technology used for operation consistent with the other policies and rules governing the service;” and
- “Licensees/users have a fundamental obligation to protect against and the right to be protected from interference.”³²

These principles fulfill the Commission’s overarching spectrum management goal, as set forth in its Strategic Plan: to “[e]ncourage the highest and best use of spectrum domestically and internationally in order to encourage the growth and rapid adoption of new technologies.”³³

This goal is best accomplished by primary reliance on a spectrum management model that is market-oriented, rather than one that emphasizes sharing common resources to the derogation of licensees’ ability to respond to demand. The Commission’s strategic plan reaches the same conclusion, acknowledging that its “policies in regard to spectrum management may need to shift to a greater market-orientation in order to permit flexible and agile response to technological and economic factors.”³⁴ The principles outlined above will achieve this result far better than limiting licensee flexibility to respond to market forces by mandating that they share access to spectrum.

Indeed, this approach has largely been followed in some fields, such as cellular and PCS. In the case of cellular, Section 22.905 of the Commission’s rules provides: “Each channel block is assigned *exclusively* to one licensee for use in that licensee’s cellular geographic service

³² *Secondary Markets Policy Statement* at ¶ 20.

³³ Strategic Plan at 9.

³⁴ *Id.* at 10.

area,”³⁵ and Section 22.911 states that the cellular geographic service area “is the area within which cellular systems are entitled to protection.”³⁶ This right to exclusivity was extended to PCS upon its creation,³⁷ and the Commission has repeatedly held that PCS licensees have the same exclusivity as cellular licensees,³⁸ namely, “an exclusive right to use a designated portion of the electromagnetic spectrum for the term of the license.”³⁹ Moreover, the Commission has recently made clear its understanding that it has an obligation to protect the rights of exclusive licenses, telling the United States Supreme Court that “*the FCC must protect [the licensee’s] exclusive right to the spectrum and refrain from authorizing others to use that spectrum.*”⁴⁰

Shared access to spectrum does not provide licensees with market-based incentives to improve spectrum efficiency. In fact, shared use may encourage inefficiency. Under a sharing regime, licensees have little incentive to implement new technologies that will reduce the amount of spectrum they need to provide service because they will not benefit from the efficiency. Instead, the others sharing access to the spectrum would benefit at no cost. Unlike the exclusive use model where licensees are incented to be efficient in order to free up spectrum for new uses or to meet capacity demands, there is no guarantee that an efficient licensee in a shared use regime will benefit from becoming more efficient.

³⁵ 47 C.F.R. § 22.905(a).

³⁶ 47 C.F.R. § 22.911(a).

³⁷ *New Personal Communications Services*, GN Docket 90-314, *Memorandum Opinion and Order*, 9 F.C.C.R. 7805, 7809 (1994) (“one license per spectrum block per service area”).

³⁸ *See Regulatory Treatment of Mobile Services*, GN Docket 93-252, *Third Report and Order*, 9 F.C.C.R. at 8042 (1994); *id.*, *Further Notice of Proposed Rulemaking*, 9 F.C.C.R. at 2877.

³⁹ *Public Utility Commission of Texas*, 13 F.C.C.R. at 3503. The D.C. Circuit has accepted the exclusivity of CMRS licenses as FCC policy. *See also BellSouth Corp. v. FCC*, 162 F.3d 1215, 1223 (D.C. Cir. 1999) (“CMRS spectrum is . . . exclusive in that whatever one entity holds cannot be held by another.”).

⁴⁰ FCC Brief, *FCC v. NextWave*, Case No. 01-653, at n.10 (U.S., filed May 6, 2002) (emphasis added).

Moreover, spectrum sharing requires the Commission to engage in extensive analysis concerning the interference potential posed by the various uses of a given band and to determine in advance the level of interference that will be tolerated. As discussed in Section I.B above, this is an extraordinarily complex task that requires the Commission to consider theoretical models and test results for every combination of services and technologies that will be subject to band sharing. Exclusive licensing, on the other hand, has the benefit of making interference management largely self-enforcing through private discussions among geographically and spectrally adjacent licensees.

Exclusive flexible allocations also better serve the public interest than shared access because they facilitate the continual improvement of service quality to the public. For example, public safety and emergency services have been found to be important components of the public interest. Emergency communications and reliable E-911 service rely heavily on the existence of exclusive spectrum allocations. Under a spectrum-sharing scenario, however, it would be difficult or impossible for a licensee to provide sufficiently reliable communications to satisfy these public interest mandates or to continually improve the provision of core services to the public.

B. Establish Four Broad Usage-Based Categories For Determining Initial Allocation and Licensing Criteria

In order to carry out its spectrum management responsibilities, the Commission needs to have some baseline criteria, even when it is planning to confer flexibility for licensee response to market forces. Rather than use wholly theoretical geographic and technical criteria, the Commission should base these criteria for flexible exclusive license allocations on a limited number of actual spectrum usage models. The starting point of any allocation should be a determination that its characteristics will be developed with an orientation toward one of these broad catego-

ries. Specifically, Cingular recommends that the broad categories that would serve as the baseline for flexible allocations should be:

- Point-to-Point;
- Satellite/Airborne;
- Broadcast; and
- Point-to-Multipoint/Mobile.

These categories would establish the baseline, or starting point, for determining spectrum allocation (*e.g.*, 1 MHz, 20 MHz, 500 MHz), geographic area (*e.g.*, MTA, EAG, DMA), and technical criteria (*e.g.*, out-of-band emission, polarization and power limits), in the course of spectrum allocations. Using an appropriate category as a model allows the Commission to make informed judgments about such criteria. The four categories will promote a reasoned match of allocation with likely use. For example, satellite/airborne and point-to-multipoint/mobile allocations should be licensed by geographic areas appropriate to their categories, while point-to-point operations should generally be licensed by path.

In other words, these four categories provide a reasonable starting point for determining what, exactly, will be the parameters of the exclusive licenses that will initially be awarded, thereby minimizing the need for extensive secondary-market transactions to fine-tune the licenses to market needs. The Commission will also be able to grant licensees considerable flexibility with regard to how their spectrum is used consistent with the baseline category, as discussed below.

C. Licensees Should Be Granted Considerable, But Not Unlimited, Flexibility

As discussed above, the Commission has established rules in various services that afford licensees varying degrees of flexibility with respect to services, technology, spectrum, service

area, and implementation. It is also considering granting the flexibility to lease the use of their spectrum to others. The Commission's experience to date demonstrates that strict, service-specific rules for commercial services may artificially constrain the ability of interested parties to put spectrum to the highest and best use. Service rules lag well behind technological advances and, thus, parties must often seek waivers or rule changes to deploy new and innovative services.

With respect to new allocations, the Commission should start from the position that licensees in each of these areas will have considerable flexibility within their own area. This will accommodate licensees' need to respond to technological advances and market demands and will give them incentives to use spectrum most efficiently and to promote consumer welfare.

Complete flexibility may create too much uncertainty among potential applicants, equipment manufacturers, and the financial community backing them, regarding the market for services and equipment that will be using the band of spectrum at issue. Potential applicants are unable to make realistic assumptions about market development and will be unable to conclude that economies of scale will develop. Manufacturers, in turn, will be reluctant to design and produce equipment to operate on frequencies that may be put to myriad uses because they are unable to gauge demand for the equipment. And the financial community is reluctant to provide funding for ventures in today's environment, especially when there is substantial uncertainty about the market for the service or services at issue. The uncertainty in each of these codependent private sector groups feeds that of the others, potentially paralyzing efficient and productive use of the spectrum. The Commission can ameliorate this hesitancy of each group to bring services to fruition by granting appropriate flexibility within a given category, thereby providing a measure of certainty to spur development while allowing a variety of alternative uses.

WCS and GWCS epitomize why too much flexibility hinders the effective functioning of the marketplace.⁴¹ The broad flexibility associated with those spectrum assignments made it difficult to assess their value.⁴² For example, an entity interested in using the frequencies for a mobile application could not ascertain whether a sufficient number of licenses would be used for this purpose to drive the production of affordable CPE and related equipment. As a result, there was little or no demand for the spectrum. WCS licenses were awarded for as little as \$1 and the GWCS auction was cancelled due to lack of demand.

Assigning spectrum consistent with these four categories, along with a general idea of its expected use, balances the need for certainty and the benefits of flexibility. Applicants will know that equipment will likely be designed consistent with the general purpose of the allocation, yet will reap the benefits of flexibility. Licensees should be permitted to deploy any services or technologies that are compatible with the usage category and the interference criteria governing operations in the band. This approach would allow licensees to deploy new technologies, implement service innovations, expand capacity in response to growing demand, and otherwise respond to market forces.

Accordingly, the Commission should, generally, grant licensees (1) service flexibility consistent with the allocation's broad category and service definition; (2) technical flexibility within the interference and other parameters of the allocation, which in turn is based on the broad category; (3) unlimited flexibility to reconfigure spectrum assignments and service areas through

⁴¹ These services are discussed at greater length in Section II.E, below.

⁴² See *WCS Licensees Form Alliance to Promote Use of Idle Spectrum*, Communications Today, August 14, 1997 (“The problem right now, [bidders] say, is that potential use of the spectrum is so flexible that manufacturers do not know what equipment to invest in and, as a result, no service can be offered.”). The WCS auction was also plagued by uncertainty regarding possible interference with the neighboring Digital Audio Radio Services and international coordination issues.

transactions; and (4) the flexibility to implement a network at its own pace, without specific coverage benchmarks or deadlines, unless parity with other licensees in the same general category dictates otherwise. As discussed in the following section, the Commission should also grant licensees the flexibility to sell or lease spectrum usage rights on the secondary market without prior FCC approval.

D. Licensees Should Have the Right to Lease Spectrum to Others

The Commission has recognized that the promotion of secondary markets for spectrum will increase communications capacity and the efficiency of spectrum use.⁴³ As the Commission noted:

An effectively functioning system of secondary markets would encourage licensees to be more spectrum efficient by freely trading their rights to unused spectrum capacity, either leasing it temporarily, or on a longer term basis, or selling their rights to unused frequencies. Increased efficiency would contribute significantly to our ongoing efforts to make additional spectrum available. . .

. . . For example, a licensee holding commercial or private mobile radio spectrum or fixed wireless access spectrum in anticipation of its own growth could lease spectrum to another entity to allow the latter to meet a temporary need. . . . Arrangements such as these would produce a "win-win" result for everyone involved. The lessor would realize income while maintaining control of spectrum that it might need to meet long term strategic objectives, while the lessee would be able to make a profit by providing service to otherwise under-served customers. Users would benefit from the availability of the service and manufacturers would potentially benefit from the sale of products. The public interest would benefit from greater and more efficient use of the spectrum. These same types of benefits could accrue in situations where mid-term or longer-term leasing is implemented as well.⁴⁴

Any effective spectrum management policy must eliminate regulatory barriers to spectrum leasing and the creation of effectively functioning secondary markets.

⁴³ *Secondary Markets Policy Statement* at ¶¶ 2, 10.

⁴⁴ *Id.* at ¶¶ 12-13.

The Commission has had a rulemaking pending since November 2000 in which it is considering ways to facilitate a secondary market in spectrum usage — the so-called “spectrum leasing” docket.⁴⁵ The task force should encourage the Commission to complete that proceeding and grant licensees the ability to lease or sell spectrum use rights, subordinate to their licenses, in the secondary market. This would permit spectrum to be used by the entity that has the most economically beneficial use of it. It also would allow spectrum to be used far more efficiently than under the current system, which places administrative restrictions and requires administrative proceedings to determine whether spectrum may be used by a particular party or service and whether a particular technology may be employed. The current system disserves the public interest because it places obstacles in the way of spectrum being utilized in the manner that best responds to public demand for spectrum-based services.

Nevertheless, the Commission still must address interference concerns with respect to spectrum leasing. This does not require an administrative approval process. The Commission simply should require licensees to accept responsibility for compliance with FCC rules and for preventing interference. Licensees should be required to retain sufficient control over the use of their licensed spectrum to carry out their responsibilities to the Commission through contractual or similar means and to provide the Commission with information on their spectrum tenants on an as-needed basis. This approach would obviate the need for a complex analysis of “control” based on the arcane *Intermountain Microwave* criteria, which have little to do with interference prevention. The Commission would be better served by knowing that it can look to the licensee of record to ensure compliance with rules through the licensee’s contract with its sublicensee.

⁴⁵ See *Secondary Markets NPRM*.

E. Clear and Unambiguous Definition of the Spectrum User’s Rights and Responsibilities Is Essential to Market-Based Spectrum Management Relying on Auctions

Markets work best when the properties⁴⁶ being bought and sold are well defined, because that enhances the ability of buyers and sellers to assess their value and reach an optimal price. Uncertain or ill-defined rights, on the other hand, make it difficult for both buyers and sellers to value properties; they cause markets to work less efficiently. Markets do not work well in allocating rights that may be subject to significant change by regulators in the future. Given that the Commission’s spectrum management inherently relies on license auctions as a key market-based component, it is essential that rights and responsibilities be defined without ambiguity. Otherwise, auctions will not result in the licenses going to the parties with the highest and best use for the spectrum.

Congress adopted an auction regime because a regulatory-directed approach to spectrum assignments was interfering with the development of new technologies and services.⁴⁷ A key component of the auction regime was that “exclusive license[s]” would be awarded in order to use spectrum “more productively and efficiently.”⁴⁸ If auctions are to accomplish this objective, then uncertainty and ambiguity need to be eliminated. This will allow bidders to evaluate exclusive licenses reliably and the spectrum will be assigned in accordance with informed market forces.

The Commission’s spectrum management policy to date has not followed this exclusive licensing mandate. As the recent UWB proceeding demonstrates, the award of an “exclusive li-

⁴⁶ The term “property” here simply is a descriptor of the bundle of rights and duties constituting a license or other spectrum use authorization, not an indication that the person holding such rights “owns” them as property in a legal sense.

⁴⁷ H.R. Rep. No. 103-111, 1993 U.S.C.C.A.N. at 573.

⁴⁸ *Id.*, 1993 U.S.C.C.A.N. at 576.

licensee” pursuant to competitive bidding does *not* live up to its name, because others are not denied access to the spectrum so awarded.⁴⁹ Non-licensees are permitted *free, unlicensed, and unmonitored* access to the spectrum initially licensed through the auction mechanism, provided they can convince the Commission that they will not interfere with the “exclusive” licensee. This certainly is not what Congress intended. Congress recognized exclusivity creates certainty which, in turn, creates market value.

The Commission must ensure that its spectrum management policy promotes certainty. As demonstrated below, ill-defined licensee rights and auction procedures undermine the integrity of the entire competitive bidding process and prevent the marketplace from working effectively.

WCS/GWCS. On August 2, 1995, the Commission established the GWCS and adopted Part 26 of its Rules, setting out licensing and operating rules for the service in the 4660-4685 MHz band.⁵⁰ These rules authorized the provision over this spectrum of a wide variety of fixed and mobile service uses, such as voice, video and data transmission, private microwave, broadcast auxiliary, and ground-to-air voice and video.⁵¹ This broad flexibility, however, undermined the ability of potential applicants to make realistic assumptions about market development. Potential GWCS applicants were unable to determine whether equipment would be available for their desired uses, because manufacturers are reluctant to develop and build equipment when they are unable to gauge demand for the particular use to which the equipment will likely be put.

⁴⁹ See *UWB Order* at ¶ 271 (“This spectrum is not, and has never been, exclusive to Sprint or to any other licensee or user.”).

⁵⁰ *Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use*, ET Docket 94-32, *Second Report and Order*, 11 F.C.C.R. 624 (1995) (*GWCS Second Report and Order*).

⁵¹ *Id.* at ¶ 12.

Accordingly, on April 24, 1998, the GWCS auction was indefinitely postponed due to lack of interest.⁵²

The Commission proposed a similar flexible approach with regard to the establishment of WCS. Specifically, it proposed to authorize the provision of fixed, mobile, radiolocation, and broadcasting-satellite services over the spectrum.⁵³ A majority of commenters opposed this approach on the following grounds:⁵⁴

(1) unrestricted spectrum flexibility will harm the public interest because it would restrict competition, discourage innovation, and delay the provision of new services; (2) lack of concrete guidance from the Commission as to the service offerings permitted on WCS spectrum will inhibit manufacturers' production of equipment necessary for new services and adversely affect the associated costs and arrival of such equipment to the marketplace; (3) flexible use of this spectrum cuts against the growing need for worldwide standardized equipment allocations and would hinder manufacturers' efforts to look to the international marketplace for added demand for WCS-appropriate devices; (4) uncertainty over the types of services to be offered by adjacent WCS licensees will adversely affect development of efficient spectrum utilization plans and make coordination between adjacent markets costly and complex, which ultimately may require extensive Commission adjudication where adjacent systems are incompatible; and (5) the Commission must allocate the 2305-2320 MHz and 2345-2360 MHz bands only to services that will not impede the implementation of [previously authorized services].⁵⁵

Lucent even cited GWCS “as an example of a failed past attempt by the Commission to rely on the market to specify the initial use of a spectrum band, contending that, lacking a service definition, the development of GWCS has been neither rapid nor efficient.”⁵⁶

⁵² *Public Notice*, DA 98-792 (April 24, 1998).

⁵³ *See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service (WCS)*, GN Docket 96-228, *Report and Order*, 12 F.C.C.R. 10,785 (*WCS Report and Order*).

⁵⁴ *WCS Report and Order*, 12 F.C.C.R. at ¶¶ 17-23.

⁵⁵ *WCS Report and Order*, 12 F.C.C.R. at ¶ 17.

⁵⁶ *WCS Report and Order*, 12 F.C.C.R. at ¶ 19.

The Commission rejected all of these arguments and moved forward with its flexible use proposal.⁵⁷ The results were disastrous. The WCS auction generated little interest and licenses were awarded for as little as \$1.

700 MHz. Congress directed the FCC to reallocate the 700 MHz band from broadcasting to new uses and to auction the spectrum. Incumbent broadcasters were given the right to continue occupying this spectrum for a considerable and uncertain period of time after the reallocation and reauction of the band. As Congress previously recognized, exclusive use of spectrum establishes its market value. The uncertainty surrounding the ability of auction winners to obtain this exclusivity, however, precluded the auction process from functioning properly.

As a result, the Commission has delayed the auction of licenses in the 700 MHz band many times – in part because of uncertainty regarding when and how incumbent broadcasters will vacate the band.⁵⁸ In arguing for a delay, CTIA stated that “Without a reasonable understanding of when the band could be made available for commercial service, it is exceptionally difficult for industry to make rational business decisions as to whether even to participate in an auction.”⁵⁹ As explained by Nancy Victory, Administrator of the National Telecommunications and Information Administration (“NTIA”):

[I]f you auction spectrum too far away from the time that the bidders will actually get access to it, you have two problems. One is that the bidders don’t really know how to value the spectrum. But even more importantly from the spectrum management standpoint, you have no assurance that the people who will actually need and

⁵⁷ *WCS Report and Order*, 12 F.C.C.R. at ¶ 25.

⁵⁸ As it stands, incumbents need not leave the spectrum until 2007 at the earliest. *See* Balanced Budget Act of 1997, Pub. L. 105-33, 111 Stat. 251 (1997).

⁵⁹ Letter from Thomas E. Wheeler, President, CTIA, to Michael K. Powell, Chairman, FCC (April 3, 2002) at 2.

be in the best position to use the spectrum at the time it becomes available will actually be participating in the auction.⁶⁰

Significantly, no nationwide CMRS carriers had filed to participate in the auction, in spite of their demonstrated need for additional spectrum to roll out 3G services.⁶¹

Congress ultimately agreed that forcing the spectrum auction in spite of such uncertainty was not in the public interest, and instructed the FCC to delay auctioning most of the spectrum. Senators Ensign (R-NV) and Kerry (D-MA), who introduced the bill in the Senate to delay the auction, wrote a letter to the FCC which stated that: “Conducting an auction for valuable spectrum at a time when potential bidders have no reasonable idea as to the costs of clearing the spectrum or when the spectrum will be available for use ultimately will harm wireless consumers and the American taxpayer.”⁶² Congressman Tauzin (R-LA), Chairman of the House Energy and Commerce Committee, agreed that such uncertainty harms the auction process: “Potential bidders cannot develop business plans when there is no certainty concerning when the 700 MHz band will be vacated by broadcasters. . . .It is also impossible to assess market conditions before it is clear when the band will be available for new services and whether other spectrum will be made available for third-generation services.”⁶³

These examples demonstrate that the auction process does not function properly where the rights to be obtained via an auction are ill-defined. Potential applicants need to know when the spectrum will be cleared, the process for clearing it, what the cost of clearing it will be, and how that cost will be paid (which should include a trust fund for paying for relocation). Ac-

⁶⁰ Interview with Nancy Victory, Administrator of NTIA, published in *The Hill* (May 22, 2002).

⁶¹ See Public Notice, *Auction of Licenses for 698-746 MHz Band*, DA 02-1346 (June 7, 2002).

⁶² “In the White House and Around Town,” *The White House Bulletin* (May 3, 2002).

⁶³ “House Moves to Delay Auction of Wireless Spectrum Used by TV Stations,” *State News Service* (May 7, 2002).

cordingly, the Commission's new spectrum management policy should state that auctions will only occur (absent a Congressional mandate) after the rights to be auctioned are clearly defined. Consistent with the legislative history of Section 309(j), the Commission should ensure that auction winners receive exclusive use of the spectrum. Finally, the Commission should also make clear that the rules in place at the time spectrum is auctioned will be enforced.

As a consequence, the Task Force, in general, should recommend spectrum policies that will remove uncertainties and limitations from licenses and spectrum allocations, to protect the rights of incumbents. If market forces are to work, the holder of a license, allocation, or other spectrum assignment should have the flexibility and discretion to use it in any way permitted by previously defined limits, without having those limits diminished or disregarded later.

III. ISSUES RELATING TO INCUMBENT LICENSEES

Sections I and II addressed the central aspects of the spectrum allocation and management process, relating to numerous questions posed by the Task Force. This Section addresses a number of spectrum management issues that relate to incumbent licensees, rather than to the allocation and initial auction process.

A. Secondary Market Leasing Should Be Allowed

For the same reasons discussed above in Section II.D above, incumbent licensees should have the right to lease (or sell) spectrum usage rights to others without prior Commission approval.

B. Geographic-Area Overlays

As discussed in Section I.D above, geographic-area overlays are license areas covering defined territories exclusive of areas already licensed. In some services, such as PCS, these overlays are unnecessary, because licensing has been geographically-based from the beginning. In other services, such as SMR, the Commission has auctioned overlay licenses. In the cellular

service, however, the Commission continues to use an unwieldy combination of geographic and site-based licensing.

Originally, cellular licenses were assigned for defined geographic areas, rather than on a site-specific basis.⁶⁴ This geographic flexibility was eventually cut back when the Commission opened up “unserved” areas within these geographic areas to new applicants, redefining cellular service areas based on the antenna height and ERP at transmitter sites.⁶⁵ So far, PCS licenses have been subject to relatively pure geographic area licensing. PCS licenses are defined by geographical borders, not by the characteristics of particular sites. As a result, PCS licensees are not burdened, as cellular licensees are, by the need to file applications whenever they expand actual system coverage and thus change their system’s actual overall coverage within their license areas.

The Commission should end the unserved area cellular licensing process and employ geographic area licenses instead of service areas defined by antenna height and ERP.⁶⁶ This can be accomplished by a combination of minor additions to incumbents’ service areas and one-time auctions of the remainder.⁶⁷ Another efficient alternative, given the likely minimal auction value of the remaining areas,⁶⁸ would be simply to incorporate the unserved areas into the service area of the adjacent existing licensee on the relevant frequency block in the cellular market area

⁶⁴ See *Cellular Communications Systems*, CC Docket 79-318, *Report and Order*, 86 F.C.C.2d 469, 509 (1981), *recon.*, 89 F.C.C.2d 58, 86-87 (1982).

⁶⁵ See *Amendment of Part 22 of the Commission’s Rules to Provide for Filing and Processing of Applications for Unserved Areas in the Cellular Service*, CC Docket 90-6, *First Report and Order and Memorandum Opinion and Order*, 6 F.C.C.R. 6185 (1991).

⁶⁶ This was urged by several parties, including Cingular, in the pending 2000 Biennial Review proceeding, WT Docket 01-108.

⁶⁷ See Comments of Cingular Wireless LLC, WT Docket 01-108, at 25 (July 2, 2001).

⁶⁸ Given that the areas that remain unserved are relatively marginal and cover only small pockets of population, it is unlikely that there would be a great number of applicants willing to bid a substantial price for these fill-out licenses, so an auction might not be warranted.

(“CMA”), by expanding its boundaries to the CMA boundary, with the exception of areas already licensed to other carriers. Such expansion would be more likely to lead to expanded cellular service than auctioning stand-alone “overlay” licenses that would cover only unserved areas, which are the areas hardest to serve profitably. This would give cellular licensees the ability to respond to demand in a planned manner within the geographic area, instead of having to build out arbitrarily early (*i.e.*, not in response to demand or economic business plans), to avoid risking the creation of an opportunistic “tollbooth” license for the area.

Even an auction of the unserved areas on a geographic-area overlay basis, however, would be preferable to the *status quo*, under which carriers have only a limited ability to expand their service into such areas in a planned way. When the incumbent files an unserved area application, there is a risk of competing applications, which will delay the onset of service.

C. Service Areas for Point-to-Point Service

CMRS carriers also utilize spectrum licensed for point-to-point microwave paths in the Common Carrier Fixed Point-to-Point Microwave Service (Part 101, Subpart I) and the Private Operational Fixed Point-to-Point Microwave Service (Part 101, Subpart H). These services are essential to the support of a variety of wireless services as well as other businesses and public service organizations needing high-capacity transmission between specific facilities at fixed locations. These services should not be geographically licensed on an exclusive basis, because that would preclude the shared use of spectrum, on a coordinated, noninterfering basis, by diverse entities and would lead to spectral inefficiency.

Alternatively, one possible licensing improvement would be to grant nonexclusive block licenses for geographic areas to existing and future spectrum users, subject to coordination and noninterference requirements. This process could be administered by an independent FCC-des-

ignated frequency coordinator, similar to the frequency coordination bodies used in many private radio services, thereby eliminating the need to individually license each path.

D. Flexibility Rules

In most licensed services, the Commission should eliminate technical and operating rules that are premised on use of a specific technology. The technical limitations that are most appropriate in a market-oriented environment are those that apply at and beyond the boundaries of the licensee's rights, such as out-of-band emissions and signal strength at the geographic boundary. The rules should be interference related.

Currently, the cellular and PCS rules afford licensees considerable service and technology flexibility. Nevertheless, the Commission should eliminate rules that limit that flexibility, such as the analog cellular requirement, the requirement that analog systems utilize vertical antenna polarization, and other rules under consideration for elimination in the pending 2000 Biennial Review proceeding.⁶⁹

E. Treatment of Exclusive Licensee Incumbents Who Are Licensed Site-by-Site

In Questions 2(b), (c), and (f) in the section of the Notice addressing "Market-Oriented Allocation and Assignment Policies," the Task Force asks how the Commission should deal with incumbents who are licensed on some basis other than defined geographic areas, such as site-by-site.

There appears to be no universal way of assigning or reassigning spectrum that is currently licensed on a site-by-site or other non-geographic-area basis. Any such assignment or reassignment needs to take into account the characteristics of the existing usage. In some cases, it

⁶⁹ See *Amendment of Part 22 of the Commission's Rules to Modify or Eliminate Outdated Rules Affecting the Cellular Radiotelephone Service and other Commercial Mobile Radio Services*, WT Docket 01-108, *Notice of Proposed Rulemaking*, 16 F.C.C.R. 11,169 (2001), and comments and replies filed in response thereto.

may be appropriate to convert to exclusive geographic area licenses, by either assigning the uncovered territory to the existing licensees in the area or by auctioning territorial licenses for the unlicensed areas. In other cases it may be inappropriate to move to straight geographical licenses.

An appropriate assignment or reassignment method is particularly difficult to determine if the incumbent is expected to share its spectrum with a new spectrum use that is different from the incumbent's. This raises all of the problems discussed in Section I.B that arise when spectrum sharing is considered, as well as the additional challenge of arriving at an appropriate licensing area for the incumbents. Any combined change such as this would be very complex and would no doubt take years of rulemaking, as occurred with the relocation of fixed microwave users when PCS was overlaid on their spectrum assignments.

When a new form of service is proposed for an occupied spectrum block, an appropriate starting point for consideration would be an auction of an overlay license. For example, if a band currently used for satellite service is being considered for terrestrial use, then it would be inappropriate to simply expand the incumbents' licenses to include terrestrial service. Here, the new service is an independent service that is fundamentally different in scope, and in a different broad category (as discussed in Section II.B), from the authorized service; if it can be provided without interference to the satellite service, then it is likely to attract competing bidders. Accordingly, the new terrestrial service should be considered as a candidate for auction.

With respect to situations where spectrum is being reallocated for a new use, and the incumbents are being transitioned to other spectrum (*e.g.*, PCS supplanting fixed microwave, flexible use supplanting upper UHF channel analog television), there would not appear to be any universally applicable formula that will facilitate restructuring. Establishment of a reasonable and certain transition period and creation of incentives for an early transition (*e.g.*, reimburse-

ment rights declining and cost limitations increasing over time, conversion to secondary status after fixed period) would appear to be the key measures.

IV. GENERAL SPECTRUM POLICY ISSUES

This Section addresses a number of interrelated issues that center on how interference is to be measured, evaluated, and defined. Accordingly, the following is responsive to numerous questions posed by the Task Force.

The central issues here are that licensees' interference tolerance changes over time, and licensees should be given incentives to use their spectrum *more* efficiently rather than less so. In particular, licensees should be encouraged to introduce new technologies that are more efficient at transmitting information (*i.e.*, the 1s and 0s that represent everything from numeric pages to motion pictures) over the spectrum. Transmitting 1s and 0s more efficiently pushes the technology and the spectrum closer to their limits, which often means that the signal is more sensitive to interference or degradation than a less sophisticated signal. As a result, a licensee that pushes the technology to increase capacity or throughput will be more heavily affected than less efficient licensees by FCC decisions that allow an additional source of noise or interference to affect the spectrum used.

The Commission should encourage, not discourage, this efficient use of technology. Sharing incumbents' spectrum with new services, however, has the opposite effect. The Commission should ensure that sharing does not penalize the most innovative and efficient users of radio spectrum. This requires careful attention to the actual noise floors and operating conditions in existing and to-be-deployed radio systems. It also requires the Commission to address the interference protection needs of incumbent licensees who may have a heightened sensitivity to increased noise or interference because (1) they may be providing service today that is optimally engineered through reliance on a combination of the existing noise floor and the use of techno-

logically advanced equipment, or (2) they may be relying on introduction of emerging technologies to achieve greater spectrum efficiency.

A. The Need for Further Information on Noise Floors, Operating Conditions

In order to carry out its spectrum management tasks responsibly, the Commission needs detailed information on the actual operating conditions in the services under its jurisdiction, as well as actual noise floors in a variety of environments. The FCC's Technological Advisory Council ("TAC") was created in 1998 to "provide scientifically supportable information on those emerging technologies that could fundamentally impact the work of the FCC" and to address spectrum management issues.⁷⁰ From the outset, the TAC recognized that the FCC cannot engage in effective spectrum management until it "develop[s] a more complete understanding of the current state of the radio noise environment."⁷¹ According to the TAC:

- There "could be a very serious emerging problem caused by the explosive growth of both intentional and unintentional radio sources. The future could be very different from what we might expect from past experience. The key to getting our hands around this issue will be a good set of models for both intentional and unintentional radiators which can then be used to predict the evolution of the noise background."⁷²
- "[W]e could potentially be entering a period of rapid degradation of the noise environment. Such degradation would reduce our ability to meet the communications needs of the country. The principal negative impacts are likely to be reductions in the performance or reliability of wireless systems or increases in their costs."⁷³
- "Data on the level and the changes of the noise environment is sorely lacking, however, as neither the FCC nor industry has tracked recent noise growth nor modeled how it will increase in the future."⁷⁴

⁷⁰ FCC Technological Advisory Council, Second Meeting Report at 1 (Oct. 28, 1999).

⁷¹ Second Meeting Report at 1, 9.

⁷² Third Meeting Report at 1.

⁷³ Fourth Meeting Report at 23 (Annex 4).

⁷⁴ Fourth Meeting Report at 23 (Annex 4).

Based on these concerns, the TAC urged the FCC to immediately undertake a multi-part study of the noise floor that would include a detailed analysis of available noise floor literature, the creation of detailed noise floor models and performance of simulations; and verification of the simulations.⁷⁵ This recommendation was accepted by the FCC.⁷⁶

The first step of the study has been completed and demonstrates that:

- “[O]nly minimal information is available from U.S. sources;”⁷⁷
- “Wireless Radio is becoming an undefined monster that needs definition;”⁷⁸
- “[D]ifferent methods of analyzing noise have unfortunately yielded different results through the years;”⁷⁹
- “Until [noise floor] information is organized and analyzed, the FCC will not have a firm basis for deciding whether current noise standards are too tight, too loose, or maybe even just right”⁸⁰
- “As we enter the new millennium, new noise sources are being developed (e.g., ultrawideband devices), and other electronic devices continue to proliferate as fast as the technology and the regulatory process will allow. Many of these other individual sources of “noise” may meet the current Federal Communications Commission (FCC) rules, but in great numbers they may negatively affect the overall electromagnetic noise environment.”⁸¹

⁷⁵ Third Meeting Report at 9.

⁷⁶ See Fourth Meeting Report at 7; Fifth Meeting Report at 14.

⁷⁷ Literature Search and Review of Radio Noise and its Impact on Wireless Communications, Signal Enhancement Laboratory, Department of Electrical and Computer Engineering, Naval Postgraduate School, Monterey, California, Section 5.

⁷⁸ Literature Search and Review of Radio Noise and its Impact on Wireless Communications, Signal Enhancement Laboratory, Department of Electrical and Computer Engineering, Naval Postgraduate School, Monterey, California, Summary Comments.

⁷⁹ Sixth Meeting Report at 9 (discussing Abstract presented by George H. Hagn).

⁸⁰ Sixth Meeting Report at 9 (discussing Abstract presented by George H. Hagn).

⁸¹ Sixth Meeting Report at 25 (Annex 4: Abstract of Hagn Talk).

- “We find multiple kinds of users in the unlicensed bands that appear to be incompatible. We cannot find any useful U.S. studies that examine the situation.”⁸²
- “Unlicensed radio seems to be an enormous success, but with the proliferation of more and more systems, we are in effect participating in an unplanned experiment in real time and are not sure how to predict the final outcome.”⁸³

To move forward with the second and third steps, the American Radio Relay League (“ARRL”) was selected to compile detailed noise floor information in the 2402-2417 MHz band.⁸⁴ This band is a shared allocation between Part 97 (amateur radio), Part 15 (unlicensed devices), and Part 18 (ISM). TAC concluded that a “three-year observation interval is probably the minimum required for real world measurements to provide meaningful data trend.”⁸⁵ Preliminary information compiled from ARRL and others to date demonstrates that the rising noise floor is creating numerous problems.⁸⁶ Indeed, one report from the ARRL indicated that “[t]he noise floor is so high [in the 2.4 GHz band] as to [make the band] unusable.”⁸⁷

The TAC recognized that new unlicensed operations such as UWB should not be permitted until the noise floor study was complete.⁸⁸ The TAC also stated that experiments would be necessary to validate theories and claims before new unlicensed operations such as UWB should be permitted.⁸⁹ The TAC suggested that a large block of spectrum be carved out in a geo-

⁸² Literature Search and Review of Radio Noise and its Impact on Wireless Communications, Signal Enhancement Laboratory, Department of Electrical and Computer Engineering, Naval Postgraduate School, Monterey, California, Summary Comments.

⁸³ FCC Technological Advisory Council II, First Meeting Report, at 9 (Aug. 26, 2001) (Council II, First Report).

⁸⁴ Council II, Second Report at 1.

⁸⁵ Council II, Second Report at 10.

⁸⁶ Council II, Second Report at 10.

⁸⁷ ARRL ARIA Update (June 2002).

⁸⁸ Fourth Meeting Report at 9-10.

⁸⁹ Second Meeting Report at 7; Third Meeting Report at 1, 15; Fourth Meeting Report at 9.

graphically remote location for this testing.⁹⁰ The testing was deemed especially important given the “growing sense that there is already excessive interference and congestion in the Part 15 bands.”⁹¹

B. Definition of “Harmful Interference”

In many services, there is no service-specific definition for what constitutes harmful interference, with respect to either base station or mobile station signals. While this may not often constitute a major problem while there are exclusive licenses, defining harmful interference becomes especially important in services whose spectrum is, or will become, subject to sharing. The generic definition in Section 1.907 of the Rules — “[i]nterference that . . . seriously degrades, obstructs, or repeatedly interrupts a radio communications service”⁹² — is too loose and subjective to give licensees any confidence that they will be protected from harmful interference. Nevertheless, given that this definition is derived from the international radio regulations, it is unlikely that the Commission has the ability to redefine the term altogether. The Commission clearly does have the authority to interpret the term, within reason, based on particular circumstances, and to provide advance guidance as to how it will generally interpret the term in particular situations.⁹³

⁹⁰ Second Meeting Report at 8.

⁹¹ Fifth Meeting Report at 1, 15; Sixth Meeting Report at 2.

⁹² 47 C.F.R. §§ 1.907, 2.1(c).

⁹³ Any such determination needs to be made in a reasoned manner that does not adversely affect the investment-based expectations of incumbent licensees in reliance on the *status quo*. This was a problem that the Commission needed to address in its recent *MVDDS* proceeding, and the Commissioners differed on whether it had been resolved successfully. *See Amendment of Parts 2 and 25 of the Commission’s Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range*, ET Docket 98-206, *Memorandum Opinion and Order and Second Report and Order*, FCC 02-116 (May 23, 2002). The matter is under appeal.

It is noteworthy that the definition specifically measures whether interference is “harmful” based on its effect on the affected service. Any interpretation or codification of this definition with respect to a specific service, to be reasonable, would have to take into account the actual operating characteristics of the affected service. In two-way services such as cellular and PCS, it is essential that both the base station and the mobile station signals be addressed; each is a critical component of the service. Because the mobile unit is much lower powered than the base station, base stations may need to employ highly sensitive receivers to “hear” the mobile, and the mobile unit’s signals are much more sensitive to interference than the base station’s signals. Accordingly, analysis of whether a new spectrum use will interfere with reception of the base station’s signals is only one part of the story; how reception of the mobile’s signals will be affected is at least as important.

The noise floor is a critical factor here. Operations in a given service are often premised on the existing noise floor. Systems (including transmitters and receivers at base stations and mobile stations) have been designed to provide reliable service over a given area and with a particular quality of service based on the expected noise floor. As a result, the Commission must consider how the existing service will be affected by even a small increase in the noise floor due to a new spectrum assignment. For example, increasing the noise floor by even a few dB may adversely impact existing licensed systems and their customers in a number of ways, such as: (1) coverage, (2) system capacity, (3) reliability of data throughput, and (4) quality of voice service. To overcome these effects, licensees may have to reconfigure previously optimized systems and deploy additional facilities to regain what the noise floor increase erased. Thus, the incumbent’s service should be considered “seriously degraded, obstructed, or repeatedly interrupted,” constituting harmful interference, as a result of the newly authorized spectrum assignment.

In any event, the Commission has long recognized the futility of attempting to establish universal, objective interference criteria in situations where licensees have the flexibility of employing varied technology. When it considered this issue in 1988 in connection with alternative technology in cellular systems, it stated:

We . . . conclude that it would be impossible to prescribe a set of standards that would provide interference protection for every situation. . . . Rather than implement a set of rigorous requirements that may over protect or under protect systems, we believe that instances of interference can best be handled on a case-by-case basis through the frequency coordination process.⁹⁴

While the Commission may find it useful to set signal strength limits or similar criteria for judging interference between particular types of systems, any such criteria should only establish a presumption of interference or noninterference that would be rebuttable by appropriate evidence. The burden should be on the party seeking to override the presumption established by the criteria. Fixed criteria are more useful in establishing the boundaries of the rights granted by a license than for determining interference.

Indeed, fixed criteria for determining interference based on a snapshot of typical operating characteristics could well result in levels of interference that are harmful to more highly evolved services and technologies that are developed over time. As a result, establishment of fixed interference criteria could discourage a licensee from using an advanced, more efficient technology with a heightened sensitivity to an increase in noise floor caused by an interfering signal.

It would be appropriate to establish a licensee's rights by granting it the ability to radiate a signal that does not exceed some fixed level at the geographic boundary of its service area,

⁹⁴ *Amendment of Parts 2 and 22 of the Commission's Rules to Permit Liberalization of Technology and Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service*, GEN Docket 87-390, *Report and Order*, 3 F.C.C.R. 7033, 7035 (1988).

subject to an obligation not to cause harmful interference in actual practice, whatever the signal level. Thus, exceeding the limit would automatically give the adjacent licensee the right to insist that the signal be reduced, whether or not there is interference. It would be inappropriate, however, to conclusively presume that a signal within the limit at the boundary does not interfere with the adjacent licensee's service. Whether interference occurs, and whether it is harmful, depends on the nature of the two licensees' services and technologies and how they affect each other.

For the foregoing reasons, it would be inappropriate to use the term "interference rights" to refer to universally applicable fixed signal strength limits. These are better defined as boundary rights. These would determine, in part, the bundle of rights defining a license. At the same time, the Commission can and should consider setting signal strength limits that would establish a rebuttable presumption of interference or noninterference with respect to particular technologies and services, taking into account industry standards, prevailing noise levels, receiver characteristics, and other factors. Any such limits, however, will need to be adjusted over time as changed circumstances warrant.

With respect to exclusive area licenses, such as cellular and PCS, presumptive co-channel interference rights should be established on the basis of a prescribed maximum signal strength at the intersystem boundary, taking into account the technologies employed, and subject to agreements between the respective licensees to employ a higher or lower criterion. The permissible signal strength limit(s) at the boundary should be low enough to protect the integrity of the services that are currently offered using a given block of spectrum as well as identifiable services that are candidates for the spectrum. In each case the limits should be based on real-world oper-

ating conditions, which change over time. Therefore, the interference protections should be periodically reevaluated based on actual operating conditions.⁹⁵

Reliance on real-world operating conditions as a standard for readjustment of presumptive interference protection criteria should result in the presumptive interference rights of incumbents being increased over time in efficient services, as technological advances permit marginal increases in spectrum efficiency that could be endangered by reliance on outdated interference protection levels.⁹⁶ For example, a licensee may be able to provide effective, reliable service to a greater area or more users by employing a new technology, but to do this the licensee takes advantage of the low noise floor that results from existing levels of interfering signals. If the Commission were to authorize a new spectrum use that resulted in raising the noise floor, the licensee would no longer be able to provide service in this manner.

The cellular service provides a number of examples. Over time, mobile and base station receiver noise characteristics have improved, permitting the extension of reliable service over greater distances in rural areas. Because the 39 dB μ V/m protected service contour adopted in the 1980s did not adequately depict the actual service areas of carriers, in 1992 the Commission

⁹⁵ Any more explicit protections than those in the definition of harmful interference should be rebuttable presumptions. This is necessary to ensure that interference tomorrow is not evaluated by yesterday's standards. For example, if the interference threshold in a particular service were determined based on how that service operates today, the licensee should not be limited to that degree of interference protection *vis-à-vis* a new spectrum user, as the licensee's service evolves and becomes more sensitive to interference due to more intensive spectrum usage.

⁹⁶ Harmful interference, by definition, depends on the actual effect of an undesired signal on service. As the service evolves technologically, the level and nature of a signal that would constitute harmful interference will change. It is expected that as services make more intensive and efficient use of spectrum, they will become more sensitive to the effects of interference. To the extent the Commission wishes to reward, rather than penalize, innovation and spectrum efficiency on the part of its licensees, it should ensure that licensees receive protection from interference that takes into account the actual operating characteristics of their systems. As a result, a given interfering signal may be barred as harmful with respect to a highly-evolved service, even though it might not adversely affect a less advanced service. Again, the Commission should not evaluate tomorrow's interference based on yesterday's standards.

changed its criterion to a 32 dB μ V/m service area boundary.⁹⁷ Since then, systems have matured further, and low-powered handheld units have become nearly universal, with 3-watt mobiles becoming rare, thus reducing the signal strength of interfering units. Moreover, handheld units are often used indoors, further decreasing the strength of undesired signals. The move toward digital service has further lowered the power levels being transmitted at cellular frequencies and thereby reducing prevailing self-interference levels. As a result, the noise level resulting from signals of undesired mobile units has decreased dramatically, causing a reduction in the overall noise floor at base station receive sites.⁹⁸ In addition, the noise floor has also been reduced by improvements in base station receiver performance, with the noise figure dropping from about 8 dB to about 4 dB, permitting a further reduction of about 4 dB in the received noise floor. These developments permit high-quality service to be extended to units in areas that would have been marginal, at best, a decade ago.

Cellular systems are engineered to take advantage of prevailing conditions. As a result, the quality of service and the extent of coverage of an analog cellular system today is based on

⁹⁷ *Unserved Areas in the Cellular Service*, CC Docket 90-6, *Second Report and Order*, 7 F.C.C.R. 2449 (1992), *recon. denied*, 8 F.C.C.R. 1363 (1993) (*Unserved Areas*), *aff'd sub nom. Committee for Effective Cellular Rules v. FCC*, 53 F.3d 1309 (D.C. Cir. 1995).

⁹⁸ In a 1997 waiver request, AirCell, Inc. represented that the noise floor in a cellular system was considered to be -107 dBm at an urban cellsite, -115 dBm at a suburban cellsite, -118 dBm at a rural cellsite, and -120 dBm at a "rural quiet" cellsite. AirCell, Inc., "Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or in the Alternative, For a Declaratory Ruling" (AirCell Petition), Exhibit B, *Analysis of AirCell Flight Test Data and Its Effects on Terrestrial Cellular Operations*, at 7 (filed Oct. 9, 1997). AirCell gave little explanation for the source of these figures, but they were apparently based on information from several cellular systems in the mid-1990s. However, contemporaneous measurements by AirCell's test contractor showed that the figures on which AirCell relied had already become outmoded. The TECC Report attached to its filing showed that the measured noise floor at two rural quiet cell-sites was about -127 dBm, 7 dB lower than the -120 dBm figure that had been based on prior data. *See id.*, Exhibit C, TEC Cellular, Inc., *Final Report: AirCell Flight Test July 10-11, 1997*, at 117-18. Since then, the noise floors of typical rural, suburban, and urban cellsites have been shown to have declined substantially.

the actual prevailing noise floor in the market. If the noise floor were to be increased due to the introduction of an additional user of the cellular spectrum, the area receiving reliable cellular coverage would be shrunk, service quality would be impaired, more calls would be dropped, and “dead spots” without reliable service would be more prevalent. In other words, the new spectrum user, by raising the noise floor, would cause “harmful interference” to the incumbent cellular licensee’s service, because that is defined as “[i]nterference that . . . seriously degrades, obstructs, or repeatedly interrupts a radio communications service.”⁹⁹

A cellular system employing digital modulation, such as TDMA, GSM, or CDMA, has different operating characteristics from an analog system. As a result, the criteria for determining what interferes with an analog system may or may not be relevant to any particular digital system. The appropriate criteria for establishing a presumption of interference to a digital system need to take into account the characteristics of these technologies, and in applying the criteria it becomes necessary to consider the particular system’s design and actual operating conditions in the market at issue.

It is difficult to imagine how the Commission would be able to grant a new license overlaying the spectrum and service area of a flexible-use licensee, because a flexible-use licensee has the right to utilize varied technologies and provide many different services, and its license to do so is typically an exclusive license. *Any* use by another party of the incumbent’s spectrum in the incumbent’s service area is likely to affect operating conditions adversely and, as a result, cause harmful interference to some authorized use of the spectrum by the incumbent flexible-use licensee. Given the breadth of a flexible-use license, it is unlikely that the Commission could

⁹⁹ 47 C.F.R. §§ 1.907, 2.1(c).

establish criteria for “interference rights” that would not impair the incumbent’s ability to employ its spectrum flexibly.

C. Interference Protection Burdens

As discussed in the preceding section, the definition of harmful interference requires consideration of the effects of the interference on the affected service in light of its actual operating conditions. In this connection, the newcomer has the burden of protecting existing spectrum uses from harmful interference.¹⁰⁰ This policy, known as the “first in time, first in right” doctrine, is the “mainstay of interference protection.”¹⁰¹ Accordingly, incumbent licensees must be protected from interference caused by “later-in-time” spectrum users.¹⁰²

¹⁰⁰ See *Midnight Sun Broadcasting Co.*, 11 F.C.C. 1119 (1947); *Sudbrink Broadcasting of Georgia*, 65 F.C.C.2d 691 (1977); see also *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Dockets 98-147, 96-98, *Third Report and Order in CC Docket 98-147 and Fourth Report and Order in CC Docket 96-98*, 14 F.C.C.R. 20,912, ¶ 211 (1999); *Mobile-Satellite Service*, ET Docket 95-18, *Second Report and Order and Second Memorandum Opinion and Order*, 15 F.C.C.R. 12,315, 12,361 (2000). It is the newcomer’s burden to demonstrate that interference will not occur, and the cost of mitigating any interference that does occur is the newcomer’s obligation, as well. See *Broadcast Corp. of Georgia (WVEU-TV)*, 96 F.C.C.2d 901 ¶¶ 13-21 (1984); 91 F.C.C.2d 854, ¶10 (1981) (“the burden of correcting the interference, financial and otherwise, is upon WVEU”), *recon. denied*, 92 F.C.C.2d 910, ¶ 7 (1982) (size of the cost burden falling on newcomer not grounds for reconsideration); see also *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, ET Docket No. 92-9, *First Report and Order and Third Notice of Proposed Rule Making*, 7 F.C.C.R. 6886, 6890 (1992) (subsequent history omitted); *NAB v. FCC*, 740 F.2d 1190, 1209-1212 (D.C. Cir. 1984).

¹⁰¹ *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Dockets 98-147, 96-98, *Third Report and Order in CC Docket 98-147 and Fourth Report and Order in CC Docket 96-98*, 14 F.C.C.R. 20,912, ¶ 211 (1999).

¹⁰² See *H&B Communications Corp. v. FCC*, 420 F.2d 638 (D.C. Cir. 1969); *Public Mobile Services*, CC Docket 92-115, *Report and Order*, 9 F.C.C.R. 6513, 6558 (1994); *WKLX, Inc.*, 6 F.C.C.R. 225, 226 (1991); *Low Power Television*, BC Docket 78-253, *Report and Order*, 51 Rad. Reg. 2d (P&F) 476, ¶ 45 (1982); *Athens Broadcasting Co.*, 68 F.C.C.2d 920, 921-22 (1978); *Jack Straw Memorial Foundation*, 35 F.C.C.2d 397, *recon. denied*, 37 F.C.C.2d 544 (1972); *B & W Truck Service*, 15 F.C.C. 2d 769 (1968); *Western Cities Broadcasting, Inc.*, 5 F.C.C.R. 6177, 6179 (MMB 1990).

As a result, in rulemaking and allocation proceedings, when the Commission is considering a new use of spectrum that may have an effect on existing licensed spectrum usage, whether in the same or another band, the advocates of the new spectrum use have an obligation to demonstrate that their proposed use of spectrum will not cause harmful interference. Any such showing should include theoretical models, controlled tests, and real-world tests, as appropriate, in order to provide a record for a reasoned decision. If a new spectrum usage will result in multiple transmitters acting as potential sources of interference to an existing licensed service, the record should address the cumulative effect of multiple interference sources in the same way.

The Commission should make clear that if the proponents of a new spectrum use cannot make these required showings, then the Commission will not adopt the requested rule changes or allocations. If more evidence is needed, then the proponents should be encouraged to conduct further studies and tests using experimental licenses. Once the rule change or allocation is adopted, it may be impossible to eliminate any interference that results, particularly if the decision leads to mass use of the new technology. A high degree of certainty is needed regarding the effect on a new spectrum use on incumbent licensed services, because it may be difficult, or even impossible, to put the genie back in the bottle.

D. Uniformity of Spectrum Policy

Spectrum policy cannot be uniform as to all portions of the spectrum, given the different uses to which spectrum is put and the technological characteristics of the various frequency bands. For example, the Commission could not reasonably expect to formulate and follow a single set of policies that would cover bands that are widely employed for mass-market services to the general public, such as broadcasting or commercial mobile radio services, and also bands devoted to public safety services. Moreover, political factors, First Amendment considerations,

statutory limitations, and particularized public interest concerns will necessarily differentiate the spectrum policies that apply to some bands of spectrum.

At a minimum, the Commission's ability to follow a spectrum policy depends on whether the band at issue contains government-only spectrum allocations or shared government/non-government spectrum. Likewise, the Commission's spectrum policy must give greater weight to international requirements with respect to bands where domestic use has international implications, as in bands used for satellite service.

While the Commission probably cannot adopt a single "one size fits all" spectrum policy covering all bands and regions, it can seek to further a number of governing principles in its policies, adapted as necessary to various bands and regions.

If the Commission adopts and follows policies that give licensees exclusivity and flexibility, permitting market forces to work, then there should be no need to adopt different spectrum policies for differing geographic areas. The policies governing a given band must necessarily take into account concerns relating to urban areas, where there is contention for that band and where the environmental noise floor is higher and thus service is highly sensitive to even slight increases in the noise floor. On the other hand, because the environmental noise floor is typically lower in rural areas, rural systems may take advantage of the increased noise margin to expand coverage and thus may be highly sensitive to interference from new spectrum uses. Accordingly, the Commission should consider the noise floor and interference criteria that are appropriate for both urban and rural situations, and adopt the most conservative protections, on a worst-case basis.

E. Measurement/Prediction of Spectrum Use, Congestion, and Demand

There does not appear to be any single set of criteria that would yield useful results under varied conditions. There are criteria or benchmarks for measuring and predicting spectrum use,

congestion, and demand that are applicable to one particular type of usage — *e.g.*, broadband CMRS, broadcast television, public safety point-to-point — that may not be useful in the context of another usage. Even these are of limited accuracy or usefulness when one considers the changing characteristics of a given type of usage.

For example, criteria that might be used to measure the characteristics of broadband CMRS as it exists today as a predominantly voice-based service may be inappropriate when applied to a future version of this service, where broadband video and data services might prevail. Thus, while it may be possible to use the number of end users per megahertz per square kilometer to compare the efficiency of spectrum use in two CMRS systems today, the figure will provide no basis for comparison with the efficiency of a fully-developed third- or fourth-generation CMRS system.

Moreover, basing spectrum policy decisions on predictions of a particular type of demand or usage tends to undercut the workings of the marketplace, by causing allocations to be tailored to the results of those predictions instead of responding to changes in demand and technology through market-based flexibility rules.¹⁰³

F. Unlicensed Radio Services

Unlicensed devices play an important role, and the Commission should ensure that there are sufficient bands for unlicensed devices to operate without causing interference to licensed services. To some degree, these bands can accommodate further growth in usage through the

¹⁰³ Hazlett illustrates this fact by pointing out that a former Chairman, after “touting his commitment to market allocation of radio spectrum,” proceeded to ask panelists to “discuss ‘future spectrum demand’” by addressing a series of questions premised on the FCC making choices among services and technologies based on its assessment of priorities and competing demands, thereby indicating that the market would not be doing the allocating. *Hazlett Essay* at 557.

continued development of standards and technologies that will permit more intensive non-interfering use.

There may be limits on growth within these bands, however. To the extent the bands used for unlicensed operations cannot accommodate the growth of unlicensed device usage, the Commission should consider the establishment of additional bands allocated for operation of unlicensed devices, which would isolate these devices from bands in which licensees are entitled to operate on an exclusive basis without interference. The Commission has taken such a step in allocating spectrum for unlicensed PCS, for example.

The Commission should not, in general, overlay unlicensed use on bands where there are primary licensees entitled to interference protection. By their nature, unlicensed devices will be deployed in uncontrolled ways at unknown locations and will, in all likelihood, be used and operated by persons with little or no understanding of their interference potential. Unlicensed spectrum use will inevitably raise the noise floor, particularly when unlicensed use of a given band is widespread. Accordingly, it will be difficult or impossible to prevent or remedy interference to primary service licensees in the bands used. To avoid compromising the integrity of licensed services, the Commission should not authorize shared access to their spectrum by unlicensed devices until it has completed extensive controlled and real-world tests demonstrating that interference will not result in the worst-case scenario.

G. Facilitation of Experimentation and Innovation

New technologies and services are not necessarily dependent on new spectrum assignments. Given flexible-use rules, incumbent licensees are capable of working with manufacturers to develop, test, and deploy new technologies and services within their existing spectrum assignments. The cellular and PCS industries have done just that. Multiple second-generation digital

technologies have been tested and deployed, and now 2.5G and 3G technologies, such as GPRS and 1xRTT, are being deployed.

New services and technologies can serve as a pretext for seeking new spectrum assignments that may not really be necessary. Rather than working with existing licensees to deploy an innovative service or technology under flexible use rules, a developer may choose to use an experimental license and a pilot program to pursue a spectrum assignment, either as an overlay sharing spectrum with existing licensees or in a new band of spectrum, taking advantage of Section 7 of the Communications Act to place the burden on the incumbent licensees.

The result of this approach is to create a bias in favor of new spectrum assignments for new technologies and services, even though such new technologies and services may not really require a spectrum assignment because of flexible use rules. This can lead to an unnecessary diversion of Commission resources and, more importantly, wasteful and inefficient spectrum usage. The Commission should rely more on market forces to accommodate new services and technologies, through flexible use and similar policies, than on the inherently political process of making new spectrum assignments.

H. Receiver Standards for Establishing Interference

A determination of interference is highly dependent on the receiver employed, so the use of a receiver that is not up to current standards may result in interference that would not result from a more advanced receiver. Licensees should have an incentive to utilize efficient technology, rather than to protect their use of inefficient technology. Accordingly, within reasonable limits, licensees should be entitled to greater protection when using high-quality equipment that is resistant to interference and should *not* be entitled to enhanced protection based on out-of-date receiving equipment. Generally accepted industry-developed standards should be an objective, and absent such standards the Commission should reserve the right to set criteria. Licensees who

use more sensitive, high-quality equipment than the standard demands should not be penalized.¹⁰⁴

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¹⁰⁴ The danger is that any receiver standards that are developed will, presumably, be based on existing equipment, and most likely the prevailing models. As a result, they will be several years behind the current production state of the art and many years behind the development state of the art. Accordingly, these standards and guidelines will be out of date as soon as they are written. Such standards should not be used to conclusively determine the interference rights of licensees, and should establish no more than a rebuttable presumption. As stated above, the Commission should not evaluate tomorrow's interference based on yesterday's standards. In any event, the actual characteristics of the relevant service have to be considered and the appropriate standard(s) applied.