Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
The Spectrum Policy Task Force Report	)	ET Docket No. 02-135
	)	

To: The Commission

COMMENTS OF CINGULAR WIRELESS LLC

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SUMMARY

Cingular Wireless LLC ("Cingular") supports the Spectrum Policy Task Force's ("SPTF") attempt to develop a spectrum policy that is both responsive to the marketplace and establishes clarity regarding spectrum rights. Some of the SPTF's proposals, however, run counter to its goals and the Commission's mandate, and would seriously undermine the stability and vibrancy of the telecommunications marketplace.

Exclusive licensing should be the predominant spectrum allocation model, and licensees should be afforded flexibility within their allocations to ensure efficient spectrum use. An exclusive frequency allocation should be defined as (i) granting a single licensee the *sole* right to use (or permit others to use) the frequency at all times, within specific, defined geographic and spectral boundaries, (ii) subject to minimal limits on the use of the frequency. The Commission also should incorporate into its spectrum management policy the principle that the "exclusivity" of a license cannot be diminished during the term of the license. These rights, coupled with a strong renewal expectancy, will increase auction value, facilitate the creation of secondary markets, and spur investment and innovation in licensed services.

Exclusive licensees should have broad, but not unbridled, flexibility. The Commission's spectrum allocations should be flexible enough to allow licensees to deploy new technologies, implement service innovations, expand capacity in response to growing demand, and otherwise respond to market forces. There are some necessary limits, however, to the degree of flexibility that can be afforded to any single spectrum user. For example, clear technical rules remain necessary in all spectrum bands in order to facilitate co-existence of multiple spectrum uses in common and adjacent bands. Moreover, complete flexibility may create too much uncertainty among potential applicants, equipment manufacturers, and the financial community, regarding the market for services and equipment that will be using the band of spectrum at issue.

To strike the proper balance between the marketplace's need for certainty and the licensee's need for flexibility, the Commission should allocate spectrum pursuant to broad usage categories. Cingular recommends that the broad categories that should serve as the baseline for flexible allocations are: (1) Point-to-Point; (2) Satellite/Airborne; (3) Broadcast; and Point-to-Multipoint/Mobile. Within these usage categories, exclusive licensees should be expressly granted: (1) service flexibility; (2) technical flexibility; (3) spectrum and service area flexibility; (4) implementation flexibility; and (5) secondary market flexibility. Service flexibility should be granted only at the allocation stage, not retroactively. Other forms of flexibility may be granted retroactively because they do not affect the nature of the licenses being auctioned.

The Commission should reject the SPTF's proposal to address spectrum scarcity issues by creating easements or underlays in spectrum awarded pursuant to the exclusive licensing model. The creation of underlays and easements is inconsistent with the exclusive licensing model and undermines the marketplace inherent in exclusive licensing. In addition, most of the "commercial" spectrum below 5 GHz is extremely congested. Creating easements or underlays in this spectrum would merely create additional technical problems for incumbent licensees who are already struggling to satisfy demand.

While Cingular supports the allocation of spectrum for flexible, exclusive licenses, the value of these licenses would be directly and significantly undermined by the SPTF's proposed

interference temperature model. This model suffers from insurmountable legal, economic, and technical flaws, and should be abandoned. Congress made clear in Sections 301 and 307 of the Communications Act of 1934 that spectrum usage should be permitted only with a license, except in a relatively small number of cases. Certainly, the Commission cannot permit unlicensed use that in any way undermines or diminishes the rights of licensees using spectrum awarded pursuant to Section 301. Allowing unlicensed access to exclusively-licensed spectrum pursuant to the interference temperature model is inconsistent with the core concept of exclusive licensing. This model takes away the licensee's ability to avoid or manage interference conditions through interference management, use of alternative technologies, and other engineering approaches, and precludes the licensee from implementing technologies that may improve efficiencies and allow reception of its licensed service at levels where effective communication may not *currently* be possible.

If adopted, the interference temperature model should only be implemented after (i) the completion of a comprehensive study of the noise floor and (ii) the successful implementation of the interference temperature concept in test beds. The model should only apply to new spectrum allocations above 5 GHz on a prospective basis. In addition, the Commission must prohibit the manufacture and sale of unlicensed equipment that lacks (i) the intelligent capability to determine its cumulative impact on the noise floor/interference temperature, (ii) the ability to operate without seizing licensed channels, and (iii) the ability to immediately cease operations.

Rather than pursue the flawed underlay and interference temperature model, the Commission should facilitate spectrum access by promoting secondary markets and allocating additional spectrum for unlicensed use. Specifically, the Commission should complete its "spectrum leasing" proceeding and grant licensees the ability to lease or sell spectrum use rights, subordinate to their licenses, in the secondary market. To address interference concerns associated with secondary markets, the Commission simply should require licensees to accept responsibility for lessees' compliance with FCC rules and for preventing interference by lessees. The Commission also should commence a proceeding to assess whether there is a need for additional *unlicensed* spectrum, or whether some of this need could be satisfied by leasing spectrum from licensees via secondary markets.

Finally, the SPTF correctly notes that "some spectrum should continue to be dedicated on a command-and-control basis for public safety use." This spectrum should be allocated under a dual-usage approach that is rooted in reallocating the upper 700 MHz band to public safety to meet critical spectrum needs.

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Cingular Wireless LLC ("Cingular"), by its attorneys, hereby responds to the November 25, 2002 Public Notice seeking comment on the Spectrum Policy Task Force Report ("SPTF Report").[1]

INTRODUCTION

On June 6, 2002, the Commission announced the creation of its Spectrum Policy Task Force and sought comment regarding the adoption of a comprehensive spectrum management policy.[2] More than 200 parties – including Cingular – submitted comments covering a wide range of issues.

On November 7, 2002, the SPTF Report was issued and recommended sweeping changes in the Commission's approach to spectrum management. Cingular agrees with the seven elements identified by the SPTF as critical to an effective spectrum management policy:

- Maximum "feasible flexibility of spectrum use;"

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1 *Commission Seeks Public Comment on Spectrum Policy Task Force Report, Public Notice*, ET Docket 02-135, FCC 02-322 (rel. Nov. 25, 2002) ("*Notice*").

2 *FCC Chairman Michael K. Powell Announces Formation of Spectrum Policy Task Force, News Release* (rel. June 6, 2002); *Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commission's Spectrum Policies,* Public Notice, ET Docket 02-135, 17 F.C.C.R. 10560 (2002).

- "Clear and exhaustive definition of spectrum users' rights and responsibilities;"
- "Policies that account for all potential dimensions of spectrum usage;"
- "Incentives for efficient spectrum use;"
- "Policies that encourage grouping of spectrum 'neighbors' with technically compatible characteristics;"
- "Periodic review and revision of spectrum rules to account for technological advances;" and
- "Efficient and reliable enforcement mechanisms."[3]

Cingular also supports the SPTF's attempt to develop a spectrum policy that is both responsive to the marketplace and establishes clarity regarding spectrum rights. 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.[4] The Commission has traditionally used a command and control model for bringing order to spectrum usage. The Report correctly notes, however, that this approach to spectrum management, in many ways, has outlived its usefulness.

With limited exceptions, the command and control approach to spectrum management must be replaced by the exclusive use and commons models.[5] The Report recommends that:

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[3] SPTF Report at 4, 15-16.

[4] *See generally* Glen O. Robinson, *The Federal Communications Act: An Essay on Origins and Regulatory Purpose,* A LEGISLATIVE HISTORY OF THE COMMUNICATIONS ACT OF 1934) 3, 8-11(Max D. Paglin, ed., 1989) ("LEGISLATIVE HISTORY"); J. Roger Wollenberg, *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.").

[5] SPTF Report at 38. Cingular concurs with the SPTF that the command and control approach should be limited to spectrum uses, such as public safety, "that provide clear, non-market public interest benefits" or to conform to treaty obligations. SPTF Report at 5, 41.

> the Commission should identify more spectrum for both licensed and unlicensed uses under flexible rules, and should transition existing spectrum that is subject to more restrictive command and control regulation to the[] [exclusive use and commons] models. . .[6]

Under the exclusive use model, which the SPTF suggests should be used to award spectrum in most cases,[7] particularly below 5 GHz, licensees would receive clearly defined, *exclusive* rights to spectrum. Under the commons model, which the SPTF suggests should be used only in instances where there is little demand for the spectrum and transaction costs for acquiring the spectrum would be high, licensees would share spectrum.[8]

On its face, this spectrum management approach is consistent with the public interest. Auctions of exclusive allocations generally are preferable to shared spectrum access. Auctions allow the market to function effectively and ensure that spectrum is put to its highest and most effective use. Exclusive allocations, in turn, 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, only works properly if there is certainty and clarity *in advance* concerning the rights and responsibilities of licensees. The FCC must also stand by these determinations *after* the auction to assure an orderly market and the fulfillment of its explicit and implicit "contractual" obligations as auctioneer.

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[6] SPTF Report at 37.

[7] SPTF Report at 38 ("The exclusive use model should be applied to most spectrum particularly in bands where scarcity is relatively high and transaction costs associated with market-based negotiation of access rights are relatively low").

[8] SPTF Report at 39 ("The commons model should be applied to significant portions of the spectrum, particularly in bands where scarcity is low and transaction costs associated with market mechanisms are high").

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 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.

Unfortunately, by proposing to allow shared access to exclusive use spectrum, the SPTF Report undermines the exclusive use model and relies on a flawed interference temperature model to avert interference. As discussed below, the interference temperature approach would inhibit market forces from operating effectively and would limit the flexibility purportedly granted "exclusive" licensees. These comments focus on the merits of exclusive licensing and the problems associated with the interference temperature model. Cingular also urges the Commission to improve spectrum access by resolving the spectrum leasing docket immediately and to refrain from extensive revisions to its interference rules.

DISCUSSION

I. EXCLUSIVE LICENSING SHOULD BE THE PRIMARY SPECTRUM ALLOCATION MODEL

In adopting a spectrum management policy, the Commission should adopt a flexible allocation process that allows the market to operate effectively. As the SPTF notes, "spectrum policy must evolve towards more flexible and market-oriented regulatory models."[9] The marketplace, rather than the Commission, generally should determine how spectrum will be used

[9] SPTF Report at 3.

and who will use it.[10] Accordingly, as suggested in Cingular's initial comments,[11] the Commission's role should be limited to: ensuring interference-free operation by licensees, creating very broad usage categories for each spectrum allocation,[12] and protecting statutorily-mandated eligibility criteria.[13] The Commission's rules should carry a presumption that licensees and unlicensed users are permitted "to do anything not explicitly prohibited by the Communications Act, the Commission's rules, Commission orders, licenses or authorizations."[14]

Congress has expressed its desire that the Commission refrain from adopting regulations that inhibit the operation of market forces.[15] The Commission's stated intention "to place ultimate reliance on the market, rather than on regulation to direct the course of development in

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10 *Accord* FCC, OPP Working Paper Series No. 38, *A Proposal for a Rapid Transition to Market Allocation of Spectrum* (authored by Evan Kwerel and John Williams) (2002) at 3.

11 Comments of Cingular Wireless LLC, ET Docket No. 02-135 at 20-21 (July 8, 2002) ("Cingular Comments").

12 As discussed below, the broad categories should be: point-to-point, satellite/airborne, broadcast, and point-to-multipoint/mobile.

13 *See, e.g.*, 47 U.S.C. § 310(b).

14 SPTF Report at 18.

15 *See* 47 U.S.C. §§ 10, 11; *accord 2000 Biennial Regulatory Review, Spectrum Aggregation Limits for Commercial Mobile Radio Services,* WT Docket 01-14, *Report and Order*, 16 F.C.C.R. 22668, 22926 (2001) ("*2000 Biennial Order*") (noting that the 1996 Act expressed the Congressional belief that "the operation of market forces generally better serv[es] the public interest than regulation"); *1998 Biennial Regulatory Review Spectrum Aggregation Limits for Wireless Telecommunications Carriers*, WT Docket 98-205, *Report and Order*, 15 F.C.C.R. 9219, 9222 (1999) ("*1998 Biennial Order*") (same); *Petition of New York State Public Service Commission to Extend Rate Regulation,* 10 F.C.C.R. 8187, ¶18 (1995) (noting that the 1993 Act reflects a general Congressional "preference in favor of reliance on market forces rather than regulation" and that Section 332(c) "empowers the Commission to reduce CMRS regulation, and [] places on [the FCC] the burden of demonstrating that continued regulation will promote competitive market conditions.").

the CMRS and other markets" is consistent with Congress' directive.[16] The SPTF properly concludes that the Commission's traditional "command and control" approach to spectrum management impedes the effective operation of market forces and, therefore, should be scrapped except where "necessary to accomplish important public interest objectives or to conform to treaty obligations."[17] The command and control approach is inflexible and impedes the effective functioning of the market. As technology evolves and new services are created, command and control licensees cannot immediately implement the technologies and provide the services. Rather, these licensees are required to seek approval from the FCC.

A. Exclusive Licensing Definition

Exclusive licensing should be the predominant spectrum allocation model – especially with regard to spectrum below 5 GHz.[18] As the name indicates, exclusive licensing awards private parties the "exclusive" right to use spectrum. Thus, an exclusive frequency allocation should be defined as (i) granting a single licensee the *sole* right to use (or permit others to use) the frequency at all times, within specific, defined geographic and spectral boundaries, (ii) subject to minimal limits on the use of the frequency. Such a definition is required to ensure that the marketplace functions properly.

The marketplace approach to spectrum management works most effectively under a system of exclusive licenses because the rights of each licensee are clearly understood. The licensee has the sole right to use (or lease) its assigned spectrum within a specified geographic area. This clarity increases auction value, facilitates the creation of secondary markets,

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16 *1998 Biennial Order*, 15 F.C.C.R. at 9230-31.

17 SPTF Report at 5.

18 SPTF Report at 5, 38.

facilitates the development of equipment, and provides certainty to the capital markets. Congress recognized this fact when it granted the FCC authority to award licenses via a competitive bidding process. In discussing the need for competitive bidding authority, it declared that:

> Spectrum is a scarce resource, and thus *every exclusive license granted denies someone else the use of that spectrum. This is what give[s] spectrum a market value.* [19]

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 bid its full value and invest in the facilities needed to make efficient and productive use of it.

Markets work best when the properties[20] 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, in accordance with the Communications Act of 1934, as amended (the "Act"), 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.

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[19] H.R. Rep. No. 103-111, at 249 (1993), *reprinted in* 1993 U.S.C.C.A.N. 378, 576 (emphasis added).

[20] 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.

Awarding exclusive licenses can provide the certainty necessary for markets to operate effectively. Certainty is only provided, however, if the "exclusivity" of licenses is guaranteed. Absent defensible licensee rights to "complete" exclusivity for the term of the license, the creation of an exclusive licensing allocation policy will provide little clarity and promote an inefficient marketplace. Potential applicants will be unable to value spectrum because the "exclusive" nature of their licenses could change. For example, uncertainty exists because the Commission could amend Part 15 to permit unlicensed operations in previously exclusive bands as it has done with its Part 15 rules and recent ultra-wideband ruling. Or, the Commission could amend its rules to implement an interference temperature concept that would require "exclusive" licensees to share their spectrum.[21] To eliminate this uncertainty, the Commission should adopt Cingular's proposed definition of an exclusive frequency allocation.

The Commission also should incorporate into its spectrum management policy the principle that the "exclusivity" of a license cannot be diminished during the term of the license. This concept should be included in the express terms of the license to give licensees a defensible right to use spectrum exclusively during the license term. This right, coupled with a strong renewal expectancy,[22] will spur investment and innovation in licensed services.

B. Exclusive Licensees Should Have Broad – But Not Unbridled – Flexibility

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 parties must

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[21] *See infra* pages 16-33 for a further discussion of the problems inherent in the SPTF's interference temperature concept.

[22] SPTF Report at 24, 64 (stating that "[l]icensees should still have strong renewal expectanc[ies]").

often seek waivers or rule changes to deploy new and innovative services. Accordingly, exclusive licensees should be granted flexibility to respond rapidly to market forces. Flexibility is necessary "to permit [a] flexible and agile response to technological and economic factors."[23]

Although flexibility should be a key component of an exclusive licensing regime,[24] it cannot be unbridled. As the SPTF notes:

> there are some necessary limits to the degree of flexibility that can be afforded to any single spectrum user. For example, clear technical rules (*e.g.*, power limits, interference standards) remain necessary in all spectrum bands in order to facilitate co-existence of multiple spectrum uses in common and adjacent bands.[25]

Moreover, 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. Also, 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.

WCS and GWCS epitomize why too much flexibility hinders the effective functioning of the marketplace. The broad flexibility associated with those spectrum assignments made it diffi-

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23 FCC Strategic Plan FY 2003 – FY 2008 at 15.

24 *See* SPTF Report at 38 (noting that the Commission should adopt an "exclusive use approach with flexible rules" for awarding most spectrum).

25 SPTF Report at 16.

cult to assess their value.[26] 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.[27]

1. Flexibility Should Be Consistent With Spectrum Allocation

To balance the marketplace need for certainty and the licensee's need for flexibility, the Commission should allocate spectrum pursuant to broad usage categories. Licensees would then have the flexibility to provide any services, using any technology that is consistent with the assigned usage category.[28] As noted in its initial comments, Cingular recommends that the broad categories that should serve as the baseline for flexible allocations are:

- Point-to-Point;
- Satellite/Airborne;
- Broadcast; and
- Point-to-Multipoint/Mobile.[29]

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[26] *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.

[27] More detail regarding these auctions, as well as additional examples of the harmful effects of too much flexibility, can be found in Cingular's initial comments. *See* Cingular Comments at 23, 26-31.

[28] Of course, licensees would be required to comply with interference criteria designed to protect the rights of co-channel and adjacent channel licensees.

[29] Cingular Comments at 6. These spectrum allocations should be harmonized, to the greatest extent possible, with international allocations.

These four categories provide a reasonable starting point for determining 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 amount of spectrum awarded and the type of area covered by the license (per path or geographic) would flow from each of these categories. In addition, interference criteria (*e.g.*, out-of-band emission, polarization, and power limits) could be crafted to conform to the usage category. The Commission also should keep the spectrum assigned to each of these categories grouped together and, to the extent possible, should allocate the spectrum consistent with international allocations. At a minimum, incompatible services/technologies should not be placed next to each other. Such an approach would be consistent with the SPTF's "good neighbor" proposal.[30]

Assigning spectrum consistently within 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 likely will 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. It also will provide market-based disincentives for interfering or incompatible uses.

The Commission should expressly state that exclusive licenses awarded prospectively via an auction will include: (1) service flexibility (*i.e.*, the ability to use spectrum for services of the

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[30] SPTF Report at 22. Although this good neighbor approach will alleviate problems created by incompatible, adjacent systems, it will not solve the incompatibility problems. For

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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), (4) implementation flexibility (*i.e.*, the ability to build out a network without construction or coverage requirements and deadlines), and (5) secondary market flexibility (*i.e.*, the flexibility to sell or lease spectrum usage rights on the secondary market without prior FCC approval).[31]

2. Service Flexibility Should Be Granted At Allocation Stage

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 an 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.[32]

Unlike service flexibility, other forms of flexibility do not affect the nature of the licenses being auctioned. Bidders recognize that the Commission often grants licensees additional

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(footnote continued)
example, even where systems are designed for compatible uses (*e.g.*, CMRS), the systems could utilize incompatible technologies.

[31] *See* Gregory L. Rosston and Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 50 FED. COMM. L.J. 87, 100-01 (1997); *see generally* SPTF Report at 56-57.

[32] *See* Cingular Comments at 9.

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.

Cingular generally agrees with the SPTF's approach to determining whether additional flexibility should be afforded incumbent licensees, versus reallocating the spectrum.[33] Under this analysis, additional flexibility should be afforded incumbents where:

- The flexibility awarded is consistent with the allocation category (*i.e.*, no service flexibility);
- There are numerous incumbents that would benefit from the flexibility;
- The expanded flexibility would not lead to rapid changes in the use of the band or consumer perception of the band; and
- The incumbent licensees acquired their licenses at auction *or* have made extensive investments and satisfied all construction benchmarks set forth in the Commission's rules.[34]

Under this analysis, the Commission should reject calls from the MSS industry for the flexibility to deploy terrestrial base stations because: (i) it would effectively give MSS licensees service flexibility that is not consistent with the allocation; (ii) there are very few incumbent licensees; (iii) usage and consumer perception of the MSS band would rapidly change (indeed, MSS service to rural areas would be significantly compromised); and (iv) MSS licensees did not acquire their licenses at auction, have not made substantial investments when compared to other licensee investments, and have not satisfied all FCC construction benchmarks.[35]

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33 SPTF Report at 49-50.

34 *Id.*

35 The Commission initially granted only eight 2 GHz MSS licenses. *See FCC International Bureau Authorizes New Mobile Satellite Service Systems in the 2 GHz Band*, News Release (rel. July 17, 2001). Of these eight, three MSS licensees have filed requests to waive or extend their "strictly enforced" construction milestones. Failure to meet these milestones renders

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C. Spectrum Awarded Pursuant to the Exclusive Licensing Model Must Be Protected From Government-Imposed Sharing Obligations

The SPTF's proposal to create easements or underlays in spectrum awarded pursuant to the exclusive licensing model should be rejected.[36] Easements and underlays[37] are inconsistent with the exclusive licensing model and undermine the marketplace certainty engendered by exclusive licensing. Financial institutions and bidders will be unable to properly value "exclusive" spectrum because they will be unsure whether the spectrum will become encumbered at some future date.

Most of the "commercial" spectrum below 5 GHz is already extremely congested.[38] Indeed, the SPTF notes that some bands, such as those used by cellular base stations, are heavily

(footnote continued)
MSS licenses "NULL and VOID." *E.g., Constellation Communications Holdings, Inc.*, 16 F.C.C.R. 13724, 13736 (IB/OET 2001) (emphasis in original), *app. for review pending; Mobile Communications Holdings, Inc.*, 16 F.C.C.R. 11766, 11769 (IB/OET 2001) (emphasis in original), *app. for review pending; see* 47 C.F.R. §25.143(e)(3). Two of these licensees have proposed transferring their unbuilt authorizations to another MSS licensee – ICO Global Communications (Holdings) Limited.

[36] SPTF Report at 37, 39.

[37] The term "easement" generally refers to granting unlicensed users the right to operate on a non-interfering basis within spectrum bands already occupied by licensed users. *See SPTF Report* at 58. The term "underlay" is used to refer to the SPTF's proposal that would permit unlicensed operations below the interference temperature. As noted in Cingular's initial comments, the Commission's use of the term "overlay" in this context is inaccurate. *See* Cingular Comments at 14-16; *accord Hazlett Essay* at 509, 550.

[38] *See* SPTF Comments at 42 (noting the spectrum scarcity below 5 GHz generally), 38 (congestion below 1 GHz); *Revision of Part 22 and Part 90 of the Commission's Rules to Facilitate Future Development of Paging Systems; Implementation of Section 309(j) of the Communications Act -- Competitive Bidding,* WT Docket No. 96-18, *Notice of Proposed Rulemaking,* 11 F.C.C.R. 3108 (1996) (stating that with this rulemaking the Commission plans to encourage more efficient use of spectrum in congested areas, such as PCS); *Amendment of Part 90 of the Commission's Rules to Facilitate Future Development of SMR Systems in the 800 MHz Frequency Band and Implementation of Section 309(j) of the Communications Act – Competitive Bidding 800 MHz SMR,* PR Docket No. 93-144, *Further Notice of Proposed Rulemaking,* 10 F.C.C.R. 7970, 7989 (1994) (noting that SMR spectrum is significantly more congested than

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used.[39] Creating easements and/or underlays in this spectrum (*e.g.*, unlicensed use) would merely create additional problems. Many incumbent licensees below 5 GHz already are struggling to satisfy demand. These licensees are developing new technologies and mechanisms for improving service quality and increasing capacity. As discussed more fully in the next section, the creation of easements and underlays will inhibit these efforts.

Moreover, the perception that easements and underlays are needed to satisfy demand for unlicensed spectrum may be incorrect. For some time, the computer industry has been pushing for access to additional spectrum to satisfy increasing demand for wireless connectivity.[40] Traditionally, the perception has been that this demand requires the creation of additional bands for unlicensed operations.[41] As noted in the most recent report issued by the Commission's Technological Advisory Council, shared spectrum may not satisfy these demands:

> All signs indicate that wireless connectivity is increasingly seen as an important, if not vital, part of modern life but the increasing demand for various wireless services is tempered by simple economics. Usable spectrum is scarce and therefore incredibly expensive. . . . Unfortunately, shared spectrum use implies mutual interference between systems whose owners, traffic types, or service objectives may be completely different. The prospect of spending development dollars for equipment and services which may be rendered worthless by perfectly legal interference from

(footnote continued)
broadband or cellular); Spectrum Policy Task Force, Report of the Spectrum Rights and Responsibilities Working Group at 13 (Nov. 15, 2002) (noting the rapid proliferation of PCS).

[39] SPTF Report at 10.

[40] *See, e.g.*, Letter of Microsoft Corp., ET Docket No. 02-135, at 4 (July 8, 2002) ("Microsoft Letter"); Comments of the Information Technology Industry Council, ET Docket No. 02-135, at 7 (July 8, 2002); Comments of Consumer Electronics Ass'n, ET Docket No. 02-135, at 5-6 (July 8, 2002).

[41] *See supra* note 38.

> another system has an appropriately chilling effect on technology and service development. . . .[42]

The TAC Report went on to describe this situation as "like a nightmare" because unlicensed operations create the possibility that a business plan could be destroyed by the deployment of a "noise-bomb" application.[43]

The creation of easements and underlays within already congested spectrum is not the solution to the demand or noise-bomb problems. The solution may lie in the creation of new unlicensed bands that are allocated for certain compatible, broad categories of uses.[44] Alternatively, permitting exclusive licensees the freedom to lease spectrum with only minimal restrictions will free up additional spectrum through market mechanisms. If spectrum is needed for economically valuable uses, the marketplace will facilitate its location. Consortia could be created to lease spectrum from nationwide carriers for unlicensed wireless networking on a secondary basis.[45] The lessee would be required to operate under the service rules in place for that particular band and the parties would be free to negotiate the interference criteria that would govern them.

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[42] FCC Technological Advisory Council II, Sixth Meeting Report at 14 (Sept. 18, 2002) ("TAC II Sixth Report").

[43] A noise-bomb is the deployment of an incompatible service or technology that precludes or damages other uses. TAC II Sixth Report at 15. As Microsoft noted, the current rules for unlicensed uses "permit[] less than optimal use of the available frequencies. Inevitably, where there are virtually no rules of the road and anything is possible, some entrepreneur will design a technology that interferes with other technologies – sometimes because it must, sometimes simply because it is cheaper." Microsoft Letter at 4.

[44] *Accord* Consumer Electronics Ass'n Comments at 7-8.

[45] Alternatively, where nationwide coverage is not needed, spectrum could be leased from carriers with more limited geographic scope.

Exclusive allocations do not preclude spectrum sharing. Rather, exclusive allocations give the licensee the sole right to determine whether or how it will share spectrum. Market forces provide sufficient incentives for licensees to develop "intensive engineering techniques that permit economically efficient sharing of spectrum by multiple users, as for example, various space, time or frequency multiplexing techniques."[46] Exclusive licensees' rights and the incentives provided thereby, are destroyed when the Commission decides to grant an easement or to create an underlay by regulatory fiat.

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.

II. THE COMMISSION SHOULD REJECT THE INTERFERENCE TEMPERATURE CONCEPT

The Commission's spectrum management policy "must be based on clear definitions of the rights and responsibilities of both licensed and unlicensed spectrum users, particularly with respect to interference and interference protection."[47] Absent constant vigilance over harmful interference, the availability and reliability of services will be diminished due to increases in the noise floor and the diversion of limited resources to interference mitigation.

The SPTF Report ruefully attempts to promote unlicensed operations at the expense of licensed services through reliance on a flawed interference temperature model. Under this

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[46] OPP Working Paper 38 at 5.

[47] SPTF Report at 3.

model, the Commission would determine the "'worst case' environment in which a receiver would be expected to operate," including an "exclusive licensee's receiver, for a particular band."[48] This would establish the interference temperature for services operating on the band. The Commission would then create easements or underlays to permit unlicensed operations below the interference temperature in spectrum previously awarded via an exclusive licensing process.[49] The interference temperature injects substantial uncertainty into the spectrum management process. The model also undermines the fundamental nature of an exclusive allocation and is inconsistent with the general prohibition of unlicensed operations contained in the Act.

A. The Creation of Underlays and Easements to Require Licensees to Share Spectrum With Unlicensed Users Via an Interference Temperature is Inconsistent with the Act

One of the central reasons why Congress created the Commission was to end the chaos and interference that resulted from a free-for-all of spectrum usage.[50] The foundational step in creating order from this chaos is contained in Section 301 of the Act which states:

> No person shall use or operate *any apparatus* for the transmission of energy or communications or signals by radio . . . except in accordance with this Act *and with a license* in that behalf granted under the provisions of the Act.[51]

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48 SPTF Report at 28.

49 *See* SPTF Report at 30. In no event should the Commission create unlicensed easements above the interference temperature. *See* SPTF Report at 37-38. Such easements would magnify all of the problems discussed in this section.

50 *See supra* note 4.

51 47 U.S.C. § 301 (emphasis added).

Thus, by enacting Section 301, Congress resolved the spectrum chaos by prohibiting wireless transmissions without a license. By requiring licenses, Congress limited the number of occupants of the spectrum, which in turn limited the potential for interference.

In 1982, Congress adopted Section 307(e) which created a very limited exception from this license requirement to permit unlicensed operations by the citizens band radio service and the radio control service.[52] This narrow exception was subsequently extended to the aviation radio service and the maritime radio services.[53]

Licensing, not unlicensed use, is the statutory model. Congress made clear that spectrum use should be permitted only with a license, except in a relatively small number of cases. Given Section 301, the Commission's authority to permit unlicensed, intentional radiators is very limited. Certainly, the Commission cannot permit unlicensed use that in any way undermines or diminishes the rights of licensees who have complied with the licensing requirements contained in Section 301.

The adoption of an interference temperature to facilitate an explosion in unlicensed operations is inconsistent with the statutory reliance on licensing. Worse, the interference temperature concept would permit unlicensed operations to occur in spectrum already served by parties with Section 301 licenses. It would lessen the rights afforded Section 301 licensees and increase the number of unlicensed voices transmitting over already assigned spectrum. This is inconsistent with the statute.

Section 301 was designed to *prohibit* unlicensed operations, not make unlicensed use the centerpiece of the FCC's spectrum policy. Licensees should not be required to share spectrum

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52 *See* Authority to Operate Certain Radio Stations Without Individual Licenses, Pub.L. 97-259, 1982 U.S.C.C.A.N. 2280 (1982); 47 U.S.C. §307(e)

53 47 U.S.C. §307(e).

with unlicensed users pursuant to an interference temperature model. Thus, adoption and implementation of this model would violate Congress' directives in Title III of the Act.

If additional spectrum is needed for unlicensed operations, the Commission should set aside specific bands for this use.[54]

B. The Interference Temperature Model Undermines Exclusive Licensing and Discourages Innovation

In addition to the statutory issues, allowing unlicensed access to exclusively licensed spectrum pursuant to the interference temperature model is inconsistent with the core concept of exclusive licensing. It converts an exclusive license into a hybrid license where the licensee's use of the spectrum is limited by the interference temperature metric. In other words, it ensures that the licensee will increasingly face "worst case" interference conditions, and takes away the licensee's ability to avoid or manage such conditions through interference management, use of alternative technologies, and other engineering approaches. Moreover, it precludes the licensee from implementing technologies that may improve efficiencies and allow reception of its licensed service at levels where effective communication may not *currently* be possible. In essence, the interference temperature analyzes the "worst-case" scenario for receiver operations under *current* technology and usage conditions and precludes licensees from addressing this scenario as technology evolves.

For example, when CDMA was developed, it allowed licensees to operate at signal levels previously viewed as commercially unattainable (*i.e.*, "below the noise floor"). It effectively lowered the operating point for licensees deploying CDMA technology by displacing analog technology that generated a higher "interference temperature." If an interference temperature had been established based on the previously accepted analog signal levels, it is unlikely that

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[54] *See supra* pages 15-16; *accord* Consumer Electronics Ass'n Comments at 7-8.

CDMA technology would have ever developed. There would have been no reason to invest in the new technology if interference from unlicensed operations were allowed at such high levels. The existence of a predetermined interference temperature would tend to force licensed users toward the lowest common denominator, thus limiting their spectral efficiency.

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. Requiring incumbents to share spectrum with new unlicensed uses, 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 technologically advanced equipment and careful engineering and management techniques, or (2) they may be relying on the introduction of emerging technologies to achieve greater spectrum efficiency.

This is particularly true with cellular/PCS networks which always operate with noise, external interference, and self-interference, which is generated by the system itself. In general, the self-interference in the network is caused by the combination of in-cell interference and out-of-cell interference. Technologies such as joint detection, multi-user detection, and interference cancellation can effectively remove the self-interference because the statistical characteristics of the signal are well known to the receiving systems in the network (mobile and base). With these advanced technologies, the system will be limited only by the noise and external interference which cannot be removed. If unlicensed operations were allowed at power levels based on the

total interference level (including the self-interference), there would not be an incentive to deploy the advanced receiver technologies. For cellular systems, the self- interference should never be used as a guide to set the interference threshold, or temperature, for the spectrum band being used.

Similar types of improvements have been achieved in the past as evidenced in cellular systems today. Over time, mobile and base station receiver noise characteristics have improved, permitting the extension of reliable service over greater distances in rural areas. After some time, the 39 dBμV/m protected service contour adopted in the 1980s no longer adequately depicted the actual service areas of carriers. Accordingly, the Commission changed its criterion to a 32 dBμV/m service area boundary to reflect the fact that carriers were taking advantage of improved equipment and were engineering their systems consistent therewith.[55] 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, interfering signals. The move toward digital service has further lowered the power levels being transmitted at cellular frequencies, thereby reducing prevailing self-interference levels. As a result, the interference level resulting from signals of undesired mobile units has decreased dramatically, causing a reduction in the overall noise plus interference floor at base station receive sites.[56] In addition, the system noise floor has also been reduced by improvements in

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[55] *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).

[56] 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 cell site, -115 dBm at a suburban cell site, -118 dBm at a rural cell site, and -120 dBm at a "rural quiet" cell site. AirCell, Inc., "Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or in the

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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. If the interference temperature had been established during the period of 3 watt analog phones, cellular licensees would never have been able to improve efficiency by taking advantage of the lowered noise and interference levels in the cellular system.

By operating more efficiently, licensees push their technologies and their spectrum usage closer to the performance limits, which often means that the signal is more sensitive to interference or degradation than a signal in a less sophisticated system. For example, 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 external interference to affect the spectrum used. Similarly, the noise floor is generally lower in rural areas than in urban areas. Thus, rural wireless systems engineered to take advantage of this fact would be adversely affected by an interference temperature that does not account for their unique operating parameters.

The Commission must recognize that in modern, well engineered cellular/PCS systems, harmful interference will do more than simply disrupt a single phone conversation or a single

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(footnote continued)
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 supposedly 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 cell sites have been shown to have declined substantially.

user. Increased levels of interference will impact not only the call quality or data throughput, but can affect the entire cell and possibly even the network as a whole through a decrease in network capacity and coverage. It is well known in cellular system engineering principles that coverage, quality, and capacity are inter-related and when one is affected then all are affected, thus reducing the overall performance and efficiency of the system.[57]

The Commission must not take steps – such as adopting an ill formed interference temperature model – that would potentially require licensees to diminish their efficiency or service quality or increase costs of providing service to its customers. Service quality is receiving increasing attention at the state and federal levels. Carriers may be disincented from implementing more efficient technologies if unlicensed operations are allowed further access to their spectrum. Despite claims that unlicensed operations below the interference temperature would not cause interference to licensed operations, there is no guarantee, especially in worst case conditions. [58]

Moreover, there is no evidence that the interference temperature model will work in the real world. The Commission is assuming that new unlicensed devices will be able to "listen" to a particular band to sense the current interference temperature. It is not clear how a device could discriminate between an intended transmission from a licensed user of the band and a signal

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[57] *See, e.g., WCDMA for UMS* (Harri Holma and Anti Toskala eds., 2000).

[58] For example, if the interference temperature for cellular systems were set at -107dBm, based on the early 1990s estimates of urban noise and interference levels, a signal at -110 dBm (3 dB under the interference temperature) could interfere with calls in rural areas or even in certain urban areas where worst-case conditions did not previously exist. *See* 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, Exhibit B – Analysis of AirCell Flight Test Data and Its Effects on Terrestrial Cellular Operations at 7-8 (Oct. 9, 1997).

from an unlicensed device or, additionally, what signals would constitute interference as part of the interference temperature at that particular location.[59]

Even if unlicensed users stay below the prescribed interference temperature, it will be difficult or impossible to assess whether they are causing interference in any particular situation. Licensees would have to police the interference issue and pinpoint the source(s) of interference. This may be difficult if unlicensed devices become abundant within the "exclusive" licensee's service area and operate on the licensee's spectrum. First, the interference emanating from multiple unlicensed devices may present itself by degraded service quality (also resulting in diminished capacity and coverage), and would be difficult to prove, yet would still have adverse regulatory consequences for the licensee.[60] Second, it may be impossible for the licensee to stop the interference due to the "tragedy of the squatters."[61] As unlicensed devices proliferate and become accepted by the public, it may become politically untenable for the Commission to shut down the devices if they are causing interference. The burden would then be on the licensee to re-engineer its system to account for the unlicensed devices.

C. The Interference Temperature Concept is Technically Flawed

"Temperature" can be applied to quantify the received signal strength in a radio system. The analogy is with noise temperature, in which natural broadband noise is created by the random (thermal noise) and quantized (shot noise) motions of electrons in devices. The amount

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[59] *See* Motorola, A White Paper on the Exploitation of "Spectrum Holes" to Enhance Spectrum Efficiency at 2-4 (Oct. 28, 2002).

[60] Specifically, licensees could face increased regulatory pressure to improve service quality that has been degraded by unlicensed operations, which would increase carriers' costs, which would be passed on to consumers. In essence, the licensee's subscribers would foot the bill for ameliorating the interference caused by the unlicensed operations.

[61] *See* SPTF Report at 58.

of thermal noise at radio frequencies is directly proportional to absolute temperature (measured in Kelvins, K), since higher temperatures create greater average motion of electrons. A given level of noise is therefore equal to an equivalent absolute temperature.

In land-based communications systems, the concept of antenna noise temperature is well established as a way to account for the black-body radiation that occurs naturally from any object that is within the viewing angle of the antenna (and above 0 K).[62] For communications systems, the total system noise temperature (T_S) in the receiving system is generally modeled as:

$$(T_S) = T_{ANT} + T_{RF}$$

Under this model T_{ANT} represents the (external) noise temperature of the antenna due to the surrounding environment and T_{RF} represents the equivalent noise temperature of the RF receiver connected to the antenna. In this model, the noise sources are generally assumed to produce truly random noise and the noise power of each source is given by $k_B TB$ where k_B is Boltzman's constant, T is the temperature in Kelvin, and B is the bandwidth of the device.[63] According to information from the U.S. GPS Industry Council ("USGPSIC"), the antenna temperature is usually taken to be 100 K for an omni-directional antenna outdoors, accounting for ground clutter.[64] Indoors, the antenna temperature is equal to 290 K, *i.e.*, room temperature (20 degrees Celsius). In general, the antenna temperature will depend on the type of antenna and the direction it is pointed.

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62 *See* Antenna Theory and Design, Warren Stutzman and Gary Thiele, John Wiley and Sons, New York, 1998, at 401-402.

63 *Id.*

64 Comments of U.S. GPS Industry Council, ET Docket No. 98-153, Attachment B at 1 (Nov. 22, 2002).

The concept of temperature finds extensive application in the satellite and radio astronomy fields, where the distance to the sources (hundreds of km up to billions of light years) is very large. The distance between the source in the sky and the receiving antenna on the surface of the Earth varies quite little, and a single temperature can be used to adequately describe the amount of signal coming from the source. As pointed out below, however, when the distance from the interferer to the receiver is not known and could vary between a few cm and several km, a single temperature cannot fully characterize the strength of the interference.

In some applications, the application of temperature has been extended to describe non-noiselike signals. Several studies by NTIA and the ITU have included measured results showing noise temperature as a function of frequency for various environments and at various frequencies. In this case, the external noise temperature has been increased by the presence of man-made impulsive noise. Sources of man-made impulsive noise include automobile ignitions, DC motors, switches, *etc.* In this model, it is assumed that the signals produced by the man-made sources are equivalent to random, broadband noise in a statistical sense.

It appears that the SPTF is suggesting to extend the concept of "temperature" to include deterministic signals in addition to the random, broadband signals described above (*i.e.*, to include discrete sources of interference). In the past, this type of analysis has been possible through the definition of the measurement detector and the measurement bandwidth (*e.g.*, spurious emissions in Part 15). Even though the statistics of interference are different from those of true noise, the detector response can be determined for each type of signal. In this way, an equivalent "interference temperature" can be evaluated. As an extension of this idea, the

USGPSIC has proposed the following equation[65] to evaluate the total noise density (W/Hz) in a receiver:

$$N_{0,Total} = 10\log_{10}\left[k_B T_{ant} + k_B T_0\left(10^{0.1NF} - 1\right) + 10^{0.1N_i}\right].$$

In this equation, *NF* represents the noise figure of the RF receiver, T_0 represents 290 K, and N_i represents the equivalent interference density in dBW/Hz. The term N_i is related to the interference temperature ($N_i = k_B T_i$).

The problem in this case is that the limits applied to transmit power or EIRP are based on the detector output assuming a certain input signal. The properties of the detector must be defined in sufficient detail to ensure that the appropriate limits are applied to protect all conceivable radio services. Before any measurements can be made, a standard method for measuring noise and interference temperature must be defined. This includes standard performance metrics for the interference measurement device, including:

- Bandwidth (must be able to protect narrowband and broadband services);
- Noise Figure and Receiver /Sensitivity (must be able to discriminate between desired signals and interference);
- Antenna Pattern and Gain (all directions must be accounted for);
- Antenna Polarization (all possible polarizations must be accounted for); and
- Detector Response (rms, peak, quasi-peak, *etc.*).

Even when the detector characteristics are well known, there are fundamental problems with equating interference and noise temperature. The idea is theoretically naïve and will be technically unworkable.

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[65] *Id.* This equation actually represents noise plus interference density.

The "interference temperature" will be highly dependent on the geometry between the interfering transmitter and the victim receiver. Depending on geometry, the "interference temperature" could vary by many orders of magnitude, making the metric totally useless for any practical purpose. For example, a 2.4 GHz unlicensed, digitally modulated device, which is a device that could be a model for the type of "underlay" or "easement" application, can be used to illustrate a major problem with the "interference temperature" proposal. Under current rules, the device is allowed to transmit 1 Watt. Assuming a transmit bandwidth of 1 MHz, this signal corresponds to a power spectral density of $(9.89 \times 10^{-11})/d^2$ W/Hz, where d is the distance from the device, in meters (assumes free space loss, isotropic transmitting and receiving antenna gain, and perfectly matched polarization). Using the definition for thermal noise, the "interference temperature" can be translated as:

$$T_{int} = 7.17 \times 10^{12} d^{-2} \text{ K.}$$

The following table illustrates the equivalent "interference temperature" as a function of distance from the device:

Distance from Device (m)	Interference Temperature (10^{10}K)
1	717
2	179
4	44.84
8	11.2
16	2.8

Over a distance of 16 meters (a little more than 50 feet), the "interference temperature" from the device varies by a factor of 256, or some 24 dB. This demonstrates that there is a direct relationship between transmitted power (EIRP) and the signal level (or "interference temperature") at a given distance. Thus, to evaluate interference it is necessary to determine the distance from the transmitter (for a single source) or determine some sort of density of

transmitters (for several sources located in a given area). The SPTF's proposal does not account for these factors.

Even more troubling are the errors contained in the Report of the Interference Protection Working Group ("Interference Report") and carried forward into the SPTF Report regarding the numerical computation of noise power spectral density and, inversely, equivalent noise temperatures. This computation is hopefully a typographical error, but is a fundamental component of the interference temperature recommendation, yet *the computations set forth in the Interference Report will lead to the wrong answers by a factor of 23 orders of magnitude (a factor of a hundred billion trillion).*[66] For example, the noise power spectral density ($N_0 = k_B T$) at room temperature should be:

$$N_0 = 10\log_{10}\left(1.38\times10^{-23}\times290\right) = -204 \text{ dB(W/Hz)}.$$

However, using the number given in reports, this value would be erroneously calculated as:

$$N_0 = 10\log_{10}\left(1.38\times290\right) = +26 \text{ dB(W/Hz)}.$$

A difference of 230 dB !

To rectify these errors, the following corrected constants and formulas should be used:[67]

- Boltzmann's Constant:[68] $k_B = 1.3807\times10^{-23}$ W Hz^{-1} K^{-1}
- Noise Power P (W) in a bandwidth BW (Hz) assuming an equivalent noise temperature: T (K): $P = k_B\ T\ BW$. Alternatively, this formula can be expressed in the following logarithmic form, using conventional engineering units: P (dBm) $= -198.6 + 10\log\left[BW\left(\text{Hz}\right)\right] + 10\log\left[T\left(\text{K}\right)\right]$

66 Interference Report at 13, n.54.

67 Traditionally, the ° symbol is not used for temperatures expressed in units of Kelvin.

68 The units of [Watts Hertz^{-1} Kelvin^{-1}] are equivalent to [Watts Second Kelvin^{-1}] and to [Joule Kelvin^{-1}].

- The formula to solve for the equivalent noise temperature given a power (in dBm) measured across a bandwidth BW (Hz) is:

$$T(\mathrm{K}) = 10^{\left[198.6 + P(\mathrm{dBm}) - 10\log BW(\mathrm{Hz})\right]/10}$$

In summary, there are significant problems with the "interference temperature" concept. The concept is theoretically flawed and it will be impossible to implement in a truly meaningful way. It will be extremely difficult, if not impossible, to build a sensor that will accurately capture the nature of the RF environment over a complex geographic area and account for all of the characteristics of the interfering signals (direction, polarization, bandwidth, *etc.*). Based on the foregoing, the interference temperature concept as proposed by the Commission requires major modification to be physically meaningful.

D. If Adopted, the Interference Temperature Model Should Only Be Implemented After (i) the Completion of a Comprehensive Study of the Noise Floor and (ii) the Successful Implementation of the Interference Temperature Concept in Test Beds

The Commission should not incorporate the interference temperature model into its spectrum management policy until after the Commission has completed "a systematic study of the RF noise floor."[69] Moreover, prior to conducting this review, the SPTF properly urges the Commission to initiate a proceeding that would establish "a standard methodology for measuring the noise floor."[70] Any noise floor study "should include actual spectrum measurements of the RF noise/interference floor" and "the Commission should create a public/private partnership for a long-term noise (interference temperature) monitoring network."[71] Further, the noise floor and

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[69] SPTF Report at 5; *accord* SPTF Report at 64 (calling the interference temperature a "long-term objective").

[70] SPTF Report at 28.

[71] SPTF Report at 28.

interference temperature studies should be conducted under the auspices of this public/private partnership. Alternatively, the Commission could rely on the independent technical experts in the Institute of Electrical and Electronics Engineers ("IEEE") to perform these studies and report their findings.[72]

The SPTF's recommendations are consistent with those presented by its Interference Protection Working Group ("Interference Working Group"). The Interference Working Group maintained that an extensive study was a precursor to the implementation of the interference temperature concept:

> The Working Group also recommends that the Commission pursue a detailed study of the advantages and disadvantages of using interference temperature as a means of addressing spectrum access and interference acceptance in the future. Future studies should include a comprehensive assessment of the interference (noise) temperature for all regions of the country. This necessarily would be time consuming and expensive. . . .[73]

The Interference Report went on to stress that the Commission should consider incorporating the interference temperature concept into its future spectrum policy only if this study proves to be successful.[74]

These recommendations, in turn, are consistent with those presented by the TAC. As noted in Cingular's initial comments, 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."[75] Thus, the TAC urged the FCC to immediately

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72 Cingular Comments, ET Docket No. 98-153, at 5 (Nov. 22, 2002).

73 Interference Report at 28.

74 *Id.*

75 FCC Technological Advisory Council, Second Meeting Report at 1, 9 (Oct. 28, 1999).

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.[76]

Cingular is concerned that the Commission's flawed *implementation* of the TAC recommendations will be mirrored in the context of the interference temperature proposal. Specifically, the Commission adopted the TAC's noise floor recommendations[77] but, by authorizing UWB operations, it failed to heed the TAC's warning that additional unlicensed operations should not be permitted until after the completion of the noise floor studies:

- 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."[78]

- "[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."[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]

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[76] FCC Technological Advisory Council II, Second Meeting Report at 8-9 (Nov. 23, 2001).

[77] *See* FCC Technological Advisory Council, Fourth Meeting Report at 7 (Mar. 24, 2000); Fifth Meeting Report at 14 (June 28, 2000).

[78] FCC Technological Advisory Council, Third Meeting Report at 1 (Dec. 13, 1999).

[79] Fourth Meeting Report at 23 (Annex 4).

[80] FCC Technological Advisory Council, Sixth Meeting Report at 9 (Sept. 27, 2000) (discussing Abstract presented by George H. Hagn).

- "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]

- "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."[82]

A comprehensive noise floor study carried out by independent industry experts must be completed *prior* to moving forward with the SPTF's interference temperature model. As NASA noted: "All the best allocation and assignment processes which maximize the use of RF spectrum are to no avail if the RF environment becomes corrupted and interference becomes 'harmful' to radio services depending on that spectrum for the fulfillment of mission goals."[83]

Once the noise floor study is completed, the Commission should test its interference temperature model in a variety of test beds before implementing this spectrum management approach on a widespread basis, particularly in already allocated spectrum bands. These test beds are necessary to protect the rights of incumbent licensees by ensuring that sharing with unlicensed operations will not cause any interference – including service degradation (*e.g.*, reduced voice quality, reduced throughput, and/or reduced network capacity).[84]

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81 *Id.* at 25 (Annex 4: Abstract of Hagn Talk).

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

83 National Aeronautics and Space Administration Reply Comments, ET Docket No. 02-135, at 6 (July 23, 2002); *accord* Microsoft Letterat 5 (stating that "the Commission should do its own testing, including real-world deployment, to determine whether unlicensed 'underlay' technologies (such as ultra-wideband) can co-exist with individually licensed services").

84 *See* Microsoft Letter at 5.

E. The Interference Temperature Model, if Adopted, Should Only Apply to New Spectrum Allocations Above 5 GHz on a Prospective Basis

The SPTF Report sends mixed signals with respect to application of the interference temperature model to existing services. On the one hand, the Report suggests that the interference temperature concept should be applied only to "*new* spectrum allocations and assignments."[85] On the other, the SPTF urges the Commission to implement the proposals contained in the Report "in both newly allocated bands and *in spectrum that is already occupied*, but in the latter case, appropriate transitional mechanisms should be employed to avoid degradation of existing services and uses."[86] This ambiguity must be corrected to be the former if the Commission intends to implement the interference temperature concept.

Should the Commission adopt the proposed interference temperature model for promoting unlicensed operations, it should not subject existing spectrum allocations to this model. Instead, this model should only be applied prospectively after the Commission has given potential applicants clear notice. Moreover, the Commission should limit the interference temperature concept to new allocations above 5 GHz.

Spectrum below 5 GHz is already congested and adding unlicensed operations will only exacerbate the problems faced by incumbent licensees and unlicensed operators. By implementing the interference temperature only above 5 GHz, manufacturers will be incented to focus their development dollars on equipment that would operate on uncongested spectrum, instead of equipment that would operate on congested spectrum below 5 GHz. This would also accelerate the development of equipment and services capable of operating in higher bands. As the SPTF has noted, technology developments are making increased use of higher frequencies

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85 SPTF Report at 53.

86 SPTF Report at 3.

available for new uses.[87] Thus, the traditional dividing lines for prime spectrum are rapidly being erased and manufacturers should be encouraged to focus on technologies that will continue to make better use of frequencies above 5 GHz.

F. At a Minimum, the Commission Must Prohibit the Manufacture and Sale of Unlicensed Equipment that Lacks (i) the Intelligent Capability to Determine its Cumulative Impact on the Noise Floor/Interference Temperature, (ii) the Ability to Operate Without Seizing Licensed Channels, and (iii) the Ability to Immediately Cease Operations

The foundation for the interference temperature model is that intelligent equipment, such as the software defined radio, is being developed that will permit opportunistic use of spectrum.[88] Under this theory, it would be possible for unlicensed operations to occur without increasing the level of noise experienced by receivers employed by licensed operators and their subscribers. However, it seems improbable that these transmitters will know if and when they have caused interference to other systems. Consistent therewith, the Commission must test this concept on non-congested bands identified through studies. The Commission must make clear that, if an interference temperature is adopted, unlicensed operations on spectrum also occupied by licensees can occur only with these intelligent transmitters and only when there is no chance for causing interference into licensed systems.

Moreover, before the Commission creates easements for "opportunistic" unlicensed operations, the Commission should permit such operations only with transmitters capable of sensing when the incumbent licensee's system needs the frequency upon which the unlicensed transmitter is operating. Once the incumbent licensee needs a frequency, the unlicensed

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87 SPTF Report at 19.

88 SPTF Report at 13-14.

transmitter must cease operations. Equipment that is incapable of operating in this fashion should be prohibited from any opportunistic easements.[89]

Finally, if unlicensed devices are deployed on spectrum also occupied by licensed operators, they must be capable of being remotely "shut down" by the manufacturer at any time. This requirement is necessary to minimize the "squatters' rights" problem. If a licensee detects a degradation in service quality or other interference due to unlicensed operations, the licensee should be entitled to demand that the interference be eliminated.[90] Licensees should not be required to coordinate with every consumer that has purchased an offending device. Rather, the manufacturer should be responsible for eliminating the interference upon licensee request by shutting down the unlicensed devices. This could be accomplished in a number of ways: by remotely cutting the power to the device, by triggering a program that would prevent the device

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[89] This equipment also must be capable of eliminating the "hidden transmitter" problem identified by Motorola. *See* Motorola, A White Paper on the Exploitation of "Spectrum Holes" to Enhance Spectrum Efficiency at 2-4 (Oct. 28, 2002).

[90] The device manufacturer should bear the burden of conclusively rebutting an interference claim by an incumbent licensee. This approach would be consistent with the "first in time, first in right" doctrine, which is the "mainstay of interference protection." *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. 20912, 21008 (1999). *See Midnight Sun Broadcasting Co.,* 11 F.C.C. 1119 (1947); *Sudbrink Broadcasting of Georgia,* 65 F.C.C.2d 691 (1977); *see also Mobile-Satellite Service,* ET Docket 95-18, *Second Report and Order and Second Memorandum Opinion and Order,* 15 F.C.C.R. 12315, 12361 (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, 906-10 (1984); 91 F.C.C.2d 854, 857-58 (1981) ("the burden of correcting the interference, financial and otherwise," is upon the newcomer), *recon. denied,* 92 F.C.C.2d 910, 912 (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).

from transmitting, or by remotely programming the device to operate on alternate frequencies. Software defined radios should be capable of incorporating such a feature.

III. THE COMMISSION SHOULD PROMOTE SPECTRUM ACCESS BY PROMOTING SECONDARY MARKETS AND ALLOCATING ADDITIONAL SPECTRUM FOR UNLICENSED USE

A. The Commission Should Conclude Its Secondary Markets Proceeding

The Commission should heed the SPTF's suggestion that spectrum access problems could be alleviated by promptly adopting rules that would promote the creation of secondary markets for obtaining spectrum rights.[91] Any effective spectrum management policy must eliminate regulatory barriers to spectrum leasing and the creation of effectively functioning secondary markets. The Commission has had a rulemaking pending since November 2000 that addresses this very issue — the so-called "spectrum leasing" docket.[92] The Commission should complete that proceeding and grant licensees the ability to lease or sell spectrum use rights, subordinate to their licenses, in the secondary market. This generally 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 on spectrum use and control, 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

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[91] SPTF Report at 53, 55-57.

[92] *See Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, Policy Statement,* 15 F.C.C.R. 24178 (2000); *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets,* WT Docket No. 00-230, *Notice of Proposed Rule Making,* 15 F.C.C.R. 24203 (2000) ("*Secondary Markets NPRM*").

public interest because it places obstacles in the way of spectrum being utilized in the manner that best responds to market demands.[93]

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 lessees' compliance with FCC rules and for preventing interference by lessees. 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 sub-licensee.

B. Additional Spectrum Should Be Allocated For Unlicensed Use

Unlicensed devices play an important role, and the Commission should ensure that there are sufficient bands for operation of unlicensed devices without causing interference to licensed services. Additional spectrum may be necessary to address the needs of traditionally unlicensed services and devices. The Commission should commence a proceeding, however, to assess whether this demand translates into a need for additional *unlicensed* spectrum. The most recent TAC Report casts some doubt over whether additional unlicensed spectrum is needed.[94] As mentioned above, it is possible that some of these needs could be satisfied by leasing spectrum

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[93] The creation of secondary markets will not alleviate the need for additional CMRS spectrum. Comments of Cingular Wireless LLC, WT Docket No. 00-230, at 3 (Feb. 9, 2001).

[94] FCC Technological Advisory Council II, Seventh Meeting Report at 14 (Dec. 4, 2002).

from licensees via secondary markets. For example, the 5 GHz U-NII band is not heavily used. This might change as more 802.11a products come to the market. Further, the Commission has an open proceeding examining the possibility of allocating the 3650-3700 MHz band for unlicensed uses.

To the extent a record is developed demonstrating the need for additional unlicensed spectrum, 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.[95] The Commission *should not* create underlays or easements for unlicensed use in bands already licensed pursuant to Section 301 of the Act. The new unlicensed bands should be located above 5 GHz to ensure that the congestion problems below 5 GHz are not exacerbated. Allocating spectrum above 5 GHz for unlicensed devices also will spur additional innovation in these bands.

IV. THERE IS NO NEED TO RADICALLY ALTER THE COMMISSION'S INTERFERENCE RULES

A. The Interference Rules Should Be Applied Consistently

As the SPTF recognizes, there are a number of potentially conflicting references to interference in the Commission's rules.[96] These references should be harmonized,[97] but exclusive licensees should not be protected only from "harmful" interference. There should be two protection levels – licensees should be entitled to protection from "harmful" interference

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[95] The Commission must balance the need for additional unlicensed spectrum against the need for spectrum for other uses, such as CMRS.

[96] SPTF Report at 32.

[97] *Id.*

from other licensees and should be entitled to protection from *any* interference from unlicensed devices.[98] Unlicensed operations, on the other hand, should receive no interference protection.

Once these references are harmonized in the context of interference from licensed and unlicensed operations, additional rule revisions are unnecessary to define interference. As the Commission has long recognized, it would be futile to attempt establishing universal, objective interference criteria in situations where licensees have flexibility. 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.[99]

Instead of revising its rules to develop universal interference guidelines, the Commission should develop technical bulletins that explain interference in the context of each radio service.[100] For example, although the generic definition of "harmful interference" contained in Section 1.907 of the Rules — "[i]nterference that . . . seriously degrades, obstructs, or repeatedly interrupts a radio communications service"[101] — is too loose and subjective to give licensees any confidence that they will be protected from harmful interference, the definition is derived from the international radio regulations. Thus, it is unlikely that the Commission has the ability to

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98 The Commission should reject proposals for a "safe harbor" that would permit unlicensed devices to interfere with licensed operations. *See* Consumer Electronics Ass'n Comments at 6-7.

99 *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).

100 SPTF Report at 32.

101 47 C.F.R. § 1.907.

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.[102]

Before any interference bulletins can be developed, however, the Commission must complete extensive noise floor studies. Operations in a given service are often premised on the existing noise floor.

The interference bulletins should be regularly updated to address the impact of new technologies on interference obligations. For example, 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 needs 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. For example, as noted previously, link quality is intimately related to capacity and coverage and if one of these are impacted, all will be impacted to a certain extent.

Finally, the Commission should adopt the SPTF's recommendation for the development of a "best practices" handbook that would provide guidance regarding the coordination of

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[102] 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,* 17 F.C.C.R. 9614 (2002). The matter is under appeal.

spectrum usage and steps that should be taken to resolve interference issues.[103] This handbook would assist licensees both in resolving and in avoiding interference disputes.

B. The Commission Should Not Eliminate Emission Limitations or Adopt a Uniform Signal Strength Requirement

Cingular opposes the elimination of emission limitations in favor of an interference temperature or any other metric.[104] CMRS systems have been designed based on existing emission limitations and any change in this limitation would likely require extensive system modifications without any corresponding benefit to subscribers. At a minimum, there should be at least a five year transition period before any changes to emission limitations take place.[105]

The Commission should also refrain from adopting a uniform signal strength requirement.[106] This proposal is inconsistent with the Commission's efficiency goals. Carriers operating base stations with dynamic power control and newer efficient technologies will not maintain uniform signal strength throughout a service area. The signal strength will vary throughout the service area, depending upon the location and needs of subscribers and the fundamental physics of radio propagation precludes ever actually achieving a uniform signal strength. In fact, some technologies, such as CDMA, rely on constant variation of base and mobile signal strengths in response to real-time changes in conditions. A uniform signal strength also would inhibit the Commission's secondary markets initiative by prohibiting a carrier from

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103 SPTF Report at 32-33.

104 *See* SPTF Report at 30.

105 *See* SPTF Report at 32-34. Cingular does not agree with the SPTF that *any* change in technical rules should require a lengthy transition period. *See id.* The transition period should only apply where the rules would require incumbent licensees to make substantial investments in order to comply.

106 SPTF Report at 24.

lowering signal strength in a certain area in order to facilitate the provision of other services by lessees.

Cingular does support, however, the SPTF's recommendation that the Commission undertake periodic reviews to ensure that its rules are not "calibrated to older technologies."[107] Under a flexible, exclusive use approach, however, there should be little need to change the rules governing exclusive licensees. The exception would be where the amount of spectrum assigned to one of the aforementioned broad usage categories greatly exceeds demand. In such an instance, the spectrum should be reallocated and the rules would need to be re-written consistent with the new allocation. These reviews should take place at regular intervals, but substantive changes to licenses should not occur until after the expiration of the license term.

V. THE COMMISSION SHOULD ADOPT A DUAL USE APPROACH FOR SATISFYING PUBLIC SAFETY SPECTRUM NEEDS

Cingular generally supports the SPTF recommendation that "[s]ome spectrum should continue to be dedicated on a command-and-control basis for public safety use."[108] The command and control approach best addresses the goals of: (1) eliminating interference to public safety systems; (2) minimizing disruption to the existing license structure in the band; and (3) ensuring robust and reliable public safety operations. The use of a command and control model to meet public safety needs "should be carefully defined," however, and the amount of spectrum subject to a command and control model "should be limited to that which ensures that those objectives are achieved."[109] In this regard, the SPTF Report notes that there is

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107 SPTF Report at 22.

108 SPTF Report at 43.

109 SPTF Report at 41.

"considerable potential for introduction of market-oriented policies that would help rather than burden public safety...."[110]

The Report recommends a dual use approach where public safety users have the flexibility to lease their dedicated spectrum to commercial users with a "take back" mechanism when public safety use increases. Cingular supports this approach and observes that giving public safety providers the opportunity to lease spectrum capacity to commercial users has several advantages. Not only does spectrum leasing encourage spectrum efficiency, but public safety providers could use the income derived from spectrum leasing to replenish funds and improve their networks. To this end, it is essential that the Commission adopt a dual usage approach in regulating public safety – one that is rooted in reallocating the upper 700 MHz band to public safety to meet critical spectrum needs. Specifically, a portion of the upper 700 MHz band should be set aside for public safety on a command-and-control basis, while introducing flexible market-oriented policies that encourage efficient use of the spectrum which is held in reserve for emergency use.[111]

The SPTF also recommends that additional public safety spectrum needs could be addressed through "enhanced easements" rights to non-public safety spectrum.[112] As discussed below, Cingular urges the Commission to reject this approach; the reallocation of a portion of the 700 MHz band for public safety is a better solution.

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110 SPTF Report at 43.

111 *Id.*

112 SPTF Report at 44.

A. The Commission Should Improve Efficiency by Addressing Public Safety Interference Concerns

The Commission's spectrum management policy must be grounded in "clear definitions of the rights and responsibilities of both licensed and unlicensed spectrum users, particularly with respect to interference and interference protection."[113] As noted by the Interference Working Group, much of the interference concerns that have plagued public safety services could be resolved if the Commission updated the frequency coordination procedures between public safety services and adjacent licensees.[114] As Glen Nash, past President of APCO, stated at the August 2, 2002 Interference Protection Workshop: "We really don't have a[n] [interference] problem. Where we've gotten into trouble is when people don't want to play the game."[115] Dr. Andrew Clegg of Cingular Wireless LLC added that interference provisions for the PCS service (*e.g.*, informal licensee coordination) work well and, in his opinion, could serve as a model for the future.[116] Other participants at that workshop indicated that many interference problems between public safety and adjacent spectrum licensees are solved through cooperation among the parties through facilities adjustments.[117] Current interference concerns could be mitigated through better frequency coordination policies. For this reason, Cingular urges the Commission to update its frequency coordination procedures between public safety and commercial licensees.

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113 SPTF Report at 3.

114 *See* Interference Report at 2, n.5.

115 Interference Report at 2, n.6.

116 *Id.*

117 *Id.*

B. The Commission Should Reject the SPTF's Proposal to Grant Enhanced Easements in Spectrum Allocated to CMRS Providers

Cingular opposes the SPTF's proposal to grant public safety service providers enhanced easement rights to non-public safety spectrum, particularly spectrum licensed to CMRS providers. As previously noted, spectrum below 5 GHz is extremely congested. Creating enhanced easements rights in this spectrum would only create additional capacity problems at a time when capacity is critical.

CMRS providers have a legitimate need for their own capacity during emergencies. It is well-known that many individuals purchase cellular telephones for emergency situations. Wireless subscribers should be able to rely on their wireless phones to place 911 emergency calls during a regional or national emergency. The effect of granting public safety providers easement rights to CMRS spectrum during an emergency will likely cause the network to reach full capacity which will necessarily impede wireless subscribers from being able to use their wireless phones to place emergency calls. Not only is this scenario undesirable, but it places a tremendous liability on carriers which the SPTF does not address.

The creation of enhanced easements within already congested spectrum is not the solution to the public safety spectrum concerns. As demonstrated below, the better approach to resolve public safety capacity and interference issues is to allocate to public safety the upper 700 MHz band with spectrum leasing opportunities.

C. The Commission Should Reallocate the Upper 700 MHz Band to Public Safety

Dedicating substantial spectrum for interoperable public safety systems is the best solution for public safety spectrum needs. Cingular supports efforts to improve public safety communications and recognizes that in emergencies, public safety providers require sufficient spectrum for critical operations. To meet these needs, public safety systems should be

transitioned from their current fragmented allocations to a more unified allocation. By allocating unified spectrum for interoperable public safety systems, the Commission will strike an appropriate balance between improving public safety communications, minimizing interference to existing licensees, and realizing spectrum efficiency.

The solution that Cingular proposes lies in a concept paper, circulated on April 25, 2002, presented by a coalition in the Commission's 800 MHz proceeding ("Coalition Proposal").[118] The coalition is comprised of organizations representing the interests of both small and large CMRS providers, including Cingular and ALLTEL, as well as manufacturing and private radio enterprises. In essence, the Coalition Proposal advocates relocating public safety from the 800 MHz band to the 700 MHz band, and auctioning vacated 800 MHz spectrum to help pay for relocation of public safety. Highlights of the Coalition Proposal are to:

- Reallocate all of the upper 700 MHz band (UHF-TV channels 60-69) to public safety, with the exception of already auctioned guard band spectrum;[119]
- Use some of this additional spectrum for Homeland Security, Priority Access Service, and/or critical infrastructure needs depending upon what the Government determines is the best use;
- Move 800 MHz public safety licensees to 700 MHz;
- Auction vacated 800 MHz public safety spectrum;

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[118] *See* Joint Ex Parte of Cingular Wireless LLC, First Cellular, Nokia, Inc., AT&T Wireless, Southern LINC, and ALLTEL Communications, Inc., WT Docket No. 02-55 (May. 2, 2002).

[119] The Commission has reclaimed 60 MHz of upper 700 MHz broadcast spectrum (channels 60-69) and allocated 24 MHz (764-776 MHz and 794-806 MHz) to public safety; 30 MHz (747-762 MHz and 777-792 MHz) to commercial licensees; and 6 MHz to guard bands (746-747 MHz, 776-777 MHz, 762-764 MHz, and 792-794 MHz). *See, e.g., Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules*, WT Docket No. 99-168, *Second Report and Order*, 15 F.C.C.R. 5299, 5304 (2000). The Coalition Proposal would reallocate to public safety the 30 MHz of commercial spectrum at 747-762 MHz and 777-792 MHz.

- Use auction revenues to help relocate public safety to 700 MHz and fund new equipment; and

- Work with Congress to enact legislation (i) reallocating 30 MHz of spectrum currently allocated for commercial use to public safety (excludes 6 MHz of guard band spectrum already auctioned); (ii) targeting auction revenues to help fund public safety relocation; and (iii) requiring broadcasters to exit the upper 700 MHz band by December 31, 2006 or sooner.[120]

The Coalition Proposal provides several advantages over the SPTF's enhanced easement solution. Reallocating the 700 MHz spectrum per the Coalition Proposal will increase public safety spectrum from the current 33.5 MHz to 54 MHz – which will ensure that public safety providers will have sufficient capacity to operate during emergency situations. This concept, if fully implemented, also provides numerous benefits to all licensees in the 800 MHz band. For public safety licensees, interference issues will be resolved; capacity and reliability needs during an emergency situation will be guaranteed; they will gain 30 MHz of additional spectrum nationwide (20.5 MHz net); they will have a date certain for access to 700 MHz band spectrum; auction proceeds will help fund relocation and equipment upgrades; and public safety interoperability, priority access services, and other homeland security needs will be facilitated. At the same time, public safety providers could use the newly-allocated spectrum to introduce market-oriented policies (such as spectrum leasing) that would facilitate the efficient use of the additional spectrum.[121] The Coalition Proposal is the most viable solution for dealing with

[120] This spectrum is currently encumbered by television broadcasters in channels 60-69 who are permitted by statute to continue operations until at least December 31, 2006, at which time their markets are to be converted to digital television ("DTV"). *See* 47 U.S.C. § 337(e); 47 U.S.C. § 309(j)(14). By statute, however, this date may be extended if certain DTV service penetration targets are not met. *See* 47 U.S.C. § 309(j)(14)(B). Legislation would be required to require broadcasters to vacate the band by a date certain, *e.g.*, December 31, 2006 or sooner, without exception.

[121] SPTF Report at 43.

interference to public safety on a long-term basis; it prevents the need to continually revisit this issue.

CONCLUSION

For the foregoing reasons, the Commission should allocate most spectrum pursuant to exclusive licenses that grant licensees the flexibility to operate within broadly defined usage categories. This approach will minimize regulatory impacts on the marketplace and promote investment and innovation. The interference temperature model, on the other hand, should be rejected as inconsistent with exclusive licensing and as inhibiting marketplace forces. The Commission should improve spectrum access by resolving the spectrum leasing docket and should refrain from extensive revisions to its interference rules. Finally, the Commission should award public safety additional spectrum in the 700 MHz band to alleviate capacity and interference issues.

Respectfully submitted,

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