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

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

COMMENTS OF HUGHES NETWORK SYSTEMS, INC.

Hughes Network Systems, Inc. ("HNS") offers its comments on the November 15, 2002 Report of the Spectrum Policy Task Force. HNS provides its perspective as an FCC licensee of many Ku-band earth station networks in the Fixed Satellite Service (FSS), a licensee of FSS satellite networks, and as the worldwide leading manufacturer and operator of very small aperture earth terminal (VSAT) networks that operate in the FSS bands.

While HNS agrees in principle with many aspects of the report, HNS believes that much of the Report's analyses and many of its conclusions have not specifically taken into account the characteristics of satellite networks and satellite-delivered services. HNS therefore offers the following comments on the following topics addressed in the Report: receiver standards, interference temperature, and allowing greater terrestrial power in rural areas.

I. Receiver Standards

The first item listed in the Report's "Major Findings and Recommendations" is the statement that "[a]dvances in technology create the potential for systems to use spectrum more intensively *and to be much more tolerant of interference than in the past*."[1] This statement appears to be a harbinger of the Report's discussion of the need to establish receiver standards.[2]

In the context of satellite services, it is important to recognize the advances in technology over the past few decades that have facilitated the use of satellite services by a wider range of users than ever before, and also have increased the overall efficiency of satellite networks. Those advances have, among other things, facilitated the use of sub-meter satellite antennas and relatively low-powered earth terminal amplifiers. Thus, it is now possible to deliver Internet access, video, broadband, and other services directly to homes and small businesses, who, but for the option to use a small, unobtrusive antenna, would not have satellite-delivered service as a competitive service offering.

Among the technological advances that facilitate the use of smaller, more portable, and less expensive earth terminals, are (i) improved performance of earth terminal receivers themselves, and (ii) the development of spacecraft receive antennas with higher gain. The history of Ku band earth terminal development, in particular, demonstrates that "market forces," rather than regulation, have driven continued improvements in receiver performance in the satellite industry. HNS' experience is that the performance of its own earth terminal receivers has improved by about 6 dB over the past 20 years. Much of this improvement has occurred by lowering the noise floor generated by the terminal itself, which allows the use of smaller antennas. Also greater spectrum efficiency is achieved by use of advanced coding and modulation techniques.

Of course, nothing has changed the requirement that satellite earth terminals be sensitive enough to receive the relatively low signal level emanating from geostationary spacecraft located 22,300 miles away in outer space. Nor has the requirement changed that an earth terminal

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[1] *Report* at 3 (emphasis supplied).

[2] *Report* at 32.

receiver be flexible enough to tune to any channel used on the 500 MHz (or more) of downlink spectrum typically employed on an FSS spacecraft. The need to be sensitive enough to receive low-level signals from outer space, and the ability to tune a receiver over a wide range of frequencies, unfortunately, render earth terminal receivers susceptible to interference from any number of various types of terrestrial terminals that may be located nearby.

Similarly, the increased sensitivity of receive antennas on spacecraft, which allows the operation of smaller, and lower-powered, earth terminals, correspondingly makes spacecraft more sensitive to interference from other sources, such as new terrestrial users of the bands. Higher order modulation schemes that allow information to be transmitted in less bandwidth typically require a higher C/N ratio, and therefore are more sensitive to interference as well.

Thus, there is an inherent tension between (i) the increased spectrum efficiencies achieved by new satellite technologies, and (ii) the ability to accept interference from the often technically incompatible signals of terrestrial terminals. For this reason, HNS is very concerned that any attempt to impose receiver standards in the satellite context could stifle innovation and freeze today's satellite technology in place. Because of the technical issues mentioned above, unless incumbent FSS satellite operators remain unconstrained in their ability to implement new technologies and improve the quality of their service, they may lose the ability to provide services that are competitive with terrestrial offerings, and equally available throughout the U.S. at prices that are distance insensitive.

II. Interference Temperature

One of the *Report's* recommendations is that the Commission move toward allowing real-time adaptation based on the actual RF environment at any particular point in time in any particular geographic area. This concept, described by the Spectrum Policy Task Force as "interference temperature,"[3] would allow certain devices to radiate in licensed bands as long as the interference temperature with respect to the victim service remained below a certain level.

The impetus behind the proposal to allow additional use of spectrum based on "interference temperature" is the perception that many parts of the spectrum appear underutilized or used inefficiently. However today's FSS satellite networks employ very sophisticated methods for maximizing the efficient use of their allocated spectrum—they fully reuse spectrum used by other spacecraft two degrees away in the geostationary orbit, they employ dual polarization, and technology has finally developed to support widespread spot beam reuse on the earth's surface. Indeed, satellite operators have every incentive to operate efficiently: A typical individual GSO FSS spacecraft costs hundreds of millions of dollars to construct, insure, and launch before any services can begin. This alone gives satellite owners every incentive to develop and deploy the most advanced systems possible to maximize use of an asset that will be in space for 12-16 years, at a minimum.

The concept of establishing an interference temperature in FSS bands raises many difficult issues.

<u>*Defining acceptable interference*</u>. In HNS' experience, the link budgets for most FSS services provide very little margin for new sources of interference. Particularly at Ku and Ka band, the high cost of satellite capacity, power limitations on board spacecraft and at earth terminals, the need to share spectrum with adjacent satellite networks, intra-system noise, and the high level of frequency reuse within the system itself, have resulted in services that, while quite spectrum efficient, cannot be designed to co-exist with terrestrial users without a substantial loss of efficiency. Simply stated, there typically is no room to accommodate significant, new sources of interference, without seriously compromising the availability of the satellite service itself.

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[3] *Report* at 27.

This is not to say that satellite technology is static. As noted above, FSS technology has consistently evolved and improved. And as that has occurred, satellite system operators have employed those improvements to enhance the efficiency, quality, competitiveness, and cost-effectiveness of their service offerings. If the Commission had taken a "snap shot" of satellite technology twenty years ago, and developed an "interference temperature" based on that technology, it is not likely that today's Ku band VSAT services would have evolved to fill the crucial role throughout the U.S. economy that they fill today.

Twenty years ago, a typical Ku band VSAT terminal was 1.8 meters in diameter and cost about $6,000. Today, the size of VSAT terminals has dropped to as small as 0.74m and the price to end users of these small terminals has dropped to less than $1,000. Due in part to terminals that are more portable, less obtrusive, and more readily installed, than ever before, VSATs have become an essential part of the nation's "backbone" communications infrastructure. For example, countless retail establishments rely on VSAT communications for point-of-purchase confirmation and inventory control. Corporate networks use VSATs to link together operations that are widely dispersed throughout the U.S. and other countries. And federal and local governments rely on VSAT services for many critical public services and national security initiatives.

Technical Obstacles. The concept of developing a terrestrial device that could "listen" for use of a given frequency band, take the noise temperature, and then proceed to operate if the "coast were clear," raises very challenging problems in any satellite band. As the Commission knows, satellite systems use two different bands: "uplink" bands involving earth-to-space communications, and "downlink" bands involving space-to-earth communications. Each presents different issues.

(i) Earth-to-space bands. In a satellite earth-to-space "uplink" band, measuring interference would need to be done at the spacecraft itself. Each spacecraft serving the U.S. would likely "see" different levels of interference because of the different elevation angles and azimuths toward the spacecraft from terrestrial users. In other words, at some orbital locations, there would be a clearer line of sight toward the spacecraft than at other orbital locations. Thus, to ensure interference-free operations to every one on the many spacecraft that serve the U.S. in the same frequency band, measurements would need to be made separately on each potentially affected spacecraft now or soon-to-be in orbit.

One issue with making such measurements is that today's spacecraft are not designed to monitor and report the existence of new sources of terrestrial interference. Thus, a terrestrial monitoring capability would require the development of brand new technology that would need to be space qualified. Because all spacecraft are weight and power limited, adding any new equipment involves difficult commercial and technical tradeoffs. Adding any new terrestrial monitoring equipment takes away the ability to deploy other technology to provide the revenue-generating satellite service. Requiring that sacrifices be made to accommodate new terrestrial services would impose on satellite operators significant cost burdens and operational limitations. Requiring terrestrial monitoring capabilities on communications satellites also would impose the technology risk of implementing new technology that is designed solely to address externalities generated by new terrestrial use of a band.

Another issue is that many spacecraft are designed with coverage beams that serve wide geographic areas, and often multiple countries. The edge of coverage of those beams do not stop at the edge of a desired coverage area or border of a country---but rather gradually roll off. "Interference" from terrestrial sources can be received not only in the intended main beam of the satellite antenna, but in the spill over edges of these beams as well. Thus, assuming monitoring technology could be implemented, the measurements would be meaningful only if the geographic location of the interference source could be isolated, and the identity of the source ascertained. This is a very real practical problem that would need to be addressed, whether one is dealing with multiple terrestrial users within the U.S., or a single nationwide user in the U.S. and terrestrial users in Canada, Mexico and other countries that are within the spacecraft's coverage beam.

Moreover, a means would need to be developed to convey the interference environment measurement results from multiple satellites to the terrestrial networks using the band. Each terrestrial device would either need to be able to measure a signal from multiple satellites, or else be connected to a separate terrestrial source that communicates with the satellites in view of the terrestrial network. For those occasions where things do not go as planned (i.e. excessive interference is caused to one or more satellite networks), a means would need to be developed for the satellite operator(s) to actually control the terrestrial network and cause it to "power down" or turn off a number of devices that caused the interference limit to be exceeded. The latter requirement raises very real practical problems about identifying the source of the interference that caused the limit to be exceeded, and apportioning fault.

Even if those monitoring capabilities could be developed, it is not at all clear how the Commission could fashion service rules that provide satellite operators with practical certainty that terrestrial operations by large numbers of devices, possibly unlicensed devices, could be controlled. Unlicensed devices surely offer potential benefits, but they also can present a Pandora's Box of possible problems for satellite systems. If the Commission allows unlicensed devices to proliferate in bands used by licensed users without taking suitable precautions to protect FSS users, there will be no practical way to put the interfering unlicensed users back in the box—neither users of the victim service nor the Commission will be able to find them, and it may not be feasible to require that manufacturers recall the offending devices.[4]

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[4] *See, e.g., In re Review of Part 15 and other Parts of the Commission's Rules*, FCC 02-211 at para 11, (rel. July 19, 2002) (with regard to identifying radar detectors as a source of interference into Ku band VSAT systems).

(ii) Space-to-earth "downlink" bands. Satellite space-to-earth bands present different technical challenges. It is not feasible for a terrestrial monitoring device to "listen" to whether a satellite space-to-earth band is in use, and then transmit when that band is not otherwise in use. Even if a given spacecraft does not have traffic at a given frequency at a given moment, it is highly likely that the same frequency is used at the same moment on the many other spacecraft in the orbital arc. Thus, there are virtually never any parts of an FSS space-to-earth band that are "silent" at any time.

Nor does it seem feasible to determine whether there are any potentially affected earth terminals in the vicinity of the terrestrial transmitter. For example, development of the Ku band has been facilitated by Commission rules that allow the ubiquitous deployment of hundreds of thousands of earth terminals, whose precise locations are not specified in a license, and which are often redeployed to different locations as customers needs change. This policy has been applied to the Ka band as well, where HNS expects even larger numbers of advanced satellite earth terminals to be deployed. Without knowing where these terminals are located, it is not apparent how a terrestrial transmitter could take the interference temperature for a given area to determine whether its operations would cause interference to an earth station receiver.

III. INCREASED TERRESTRIAL POWER IN RURAL AREAS

The Report posits that "spectrum in rural areas is typically the least congested,"[5] and notes that "certain parties" advocate "higher permissible power standards for rural areas."[6] The Report then recommends that the Commission consider using "licensing areas that distinguish between rural and urban areas."[7] HNS opposes any possible change in the licensing rules that could

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5 *Report* at 59.

6 *Id.*

7 *Id.* at 60.

result in higher power terrestrial operations in rural and remote areas interfering with satellite services, in frequency bands that are shared between satellite and terrestrial users. Any such change could have a particularly burdensome impact on the many businesses and individuals in rural areas who rely on satellite-delivered services as their only means of service.

As the Commission knows well, satellites are uniquely suited to extend service to rural and remote customers who otherwise would be unserved or underserved by terrestrial networks. Because of their broad geographic coverage, satellite systems can extend service to these areas on a cost basis that is distance-insensitive. In fact, in many places, satellite is the most attractive, and sometimes the only, option available to those seeking multichannel video, broadband internet, mobile, advanced data, and sometimes basic business telecommunications services.

Allowing higher-power terrestrial services in rural or remote areas could preclude the ability to provide satellite service in those areas, and therefore could harm the very businesses and consumers who have limited or no alternatives for their telecommunications needs.

Rural and remote areas are, by definition, less densely populated than urban areas. That, of course, does not mean that the needs of businesses and consumers in those areas are any less important than the needs of those in urban areas. In fact, limiting the ability of satellite systems to serve rural and remote areas could cause such users disproportionate harm because of the very limited alternative sources for service in those areas, and because of the reliance of those users on satellite services.

Moreover, any attempt to define rural (versus suburban and urban) areas for purposes of allowing high-power operations poses serious logistical and definitional problems. For example, it is not feasible to define these areas on a county basis, because many counties that are classified as rural have urban components. Bay County, Michigan, for example, "is predominately rural but has an urban center (Bay City) near its southern end.[8]" Classifying an entire county as rural and allowing higher-power operations in that entire county therefore could cause interference, and disrupt communications, in nearby urban centers. Second, any "rural" classification of a given service area presumably would need to be constantly revisited to account for future growth in that area. Third, consideration would need to be given to "powering down" those terrestrial transmitters once the formerly "rural" area reached a certain level of development, and it is not at all clear how or whether the Commission could effectively require those services to "power down" simply because the population of the area had grown.

In short, HNS is very concerned that any attempt to allow higher-power terrestrial operations in rural areas in shared satellite bands, in the end, would greatly constrain the ability to provide satellite services in those areas. The importance of satellite services to rural and remote users makes it all the more important that the Commission proceed with extreme caution before changing any of the terms under which satellite systems share spectrum with terrestrial networks.

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While HNS agrees in principle with many aspects of the Spectrum Policy Task Force's Report, HNS believes that much of the Report's analyses and many of its conclusions have not specifically taken into account the characteristics of satellite networks and satellite-delivered services. HNS supports the Commission's efforts to encourage efficient use of the limited radio spectrum resource. In doing so, HNS urges the Commission to take into account the different characteristics of existing FSS services, and to heed the recommendation of the Spectrum Policy Task Force that incumbent satellite operators and users of the spectrum should remain protected from interference.[9]

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8 *See* http://medc.michigan.org/miinfo/places/BayCounty/.

9 *See Report* at 25-26.

Respectfully submitted,

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