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

In the Matter of	)	
	)	
Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies	)	ET Docket No. 03-108
	)	
Authorization and Use of Software Defined Radios	)	ET Docket No. 00-47 (Terminated)

COMMENTS OF
GLOBALSTAR, L.P., ICO GLOBAL COMMUNICATIONS,
INTELSAT GLOBAL SERVICE CORPORATION,
LORAL SPACE & COMMUNICATIONS LTD.,
NEW SKIES SATELLITES, PANAMSAT CORPORATION AND
SES AMERICOM, INC.

Globalstar, L.P., ICO Global Communications, Intelsat Global Service Corporation, Loral Space & Communications Ltd., New Skies Satellites, PanAmSat Corporation and SES Americom, Inc. (collectively, the "Satellite Companies") hereby submit comments in response to the *Notice of Proposed Rulemaking and Order* in the above-captioned proceeding, FCC 03-322 (rel. Dec. 30, 2003) (the "*NPRM*" and "*Order"* or the "*Notice*").

The Satellite Companies have serious concerns with any widespread use of cognitive radio technologies by unlicensed devices in bands that are allocated for satellite services. In particular, the Satellite Companies oppose any power increase for unlicensed devices in the band 5850-5875 MHz. It is premature to suggest increased power levels until the effect on FSS uplinks is fully analyzed to ensure that existing FSS service

quality and capacity are not impaired. In addition, the Satellite Companies question whether cognitive radio technology can be used to improve coordination in satellite spectrum given satellite operators' need for full-band, full-arc spectrum access and the high costs of implementing necessary monitoring capabilities.

I. INTRODUCTION AND SUMMARY

The Satellite Companies include leading U.S. satellite manufacturers, system operators and service providers. The Satellite Companies are also members of the Satellite Industry Association ("SIA"). The Satellite Companies submitting comments here have recently expressed their general concern with the proposed application of an interference temperature approach to permit the deployment of new unlicensed devices in bands allocated for satellite services. These concerns are detailed in comments submitted to the Commission in response to the Notice of Inquiry and Notice of Proposed Rulemaking addressing the possible establishment of an interference temperature metric (the "*Interference Temperature Comments*").[1] A number of the obstacles identified to implementation of an interference temperature approach also apply to the Commission's proposal to use cognitive radio technology as proposed in the *Notice,* and we incorporate the *Interference Temperature Comments* by reference herein.

For example, the *Notice* proposes a power increase for unlicensed devices operating in several bands including the band 5850-5875 MHz. Although unlicensed devices using cognitive radio technologies may be able to detect potential interference

[1] Comments of Globalstar, L.P., Inmarsat Ltd., Intelsat LLC, Iridium Satellite LLC, Lockheed Martin Corp., Loral Space & Communications Ltd., New Skies Satellites, Northrop Grumman Corporation, PanAmSat Corporation and SES Americom, Inc., In the Matter of Establishment of Interference Temperature Metric to Quantify and Manage Interference and To Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, ET Docket No. 03-237, filed April 5, 2004.

into them from satellite transmit earth stations operating in this band, the *Notice* completely ignores the associated increase of interference that such increase in power will have into satellite receivers. The practical difficulties associated with controlling the aggregate interference from unlicensed devices operating in satellite uplink frequency bands are discussed in detail in the *Interference Temperature Comments* at Section IV. The Satellite Companies oppose any power increase for unlicensed devices in the band 5850-5875 MHz at least until its effect on FSS uplinks is fully analyzed to protect existing services from unacceptable interference.

In addition to unlicensed devices, three other scenarios are identified in the *Notice* for the use of cognitive radio technologies: a licensee employing "cognitive radio technologies internally within its own network to increase the efficiency of use"; "secondary markets in spectrum use, implemented by voluntary agreements between licensees and third parties"; and "automated frequency coordination among licensees of co-primary services." *Notice* at ¶ 3.

The Satellite Companies are of the view that internal use within a given network is already happening under existing rules and should certainly be encouraged. No changes to the FCC's rules are required to allow such use to continue. With respect to the use of cognitive radio technologies in connection with secondary markets, the Satellite Companies believe that this is an avenue worth exploring, although possibilities in satellite bands may be somewhat limited. Finally, possibilities for automated frequency coordination between satellite earth stations and terrestrial stations are considered to be very limited, especially in satellite downlink frequency bands.

II. THE PROPOSAL TO INCREASE POWER FOR UNLICENSED DEVICES IN THE 5850-5875 MHZ BAND IS PREMATURE

The *Notice* proposes to increase the power limits for operation in the 5725-5875 MHz band under Sections 15.247 and 15.249 of the rules. *Notice* at ¶ 38. The upper 25 MHz of this band (i.e., 5850-5875 MHz) are allocated to the FSS (Earth-to-space) in Region 2. The proposed power increase for unlicensed devices will increase the interference to FSS uplinks operating in this spectrum. The Commission recognizes that each of the bands under consideration "is also used by licensed services that are entitled to protection from interference by Part 15 devices". *Notice* at ¶ 38. To ensure that FSS uplinks are protected, the Satellite Companies oppose any power increase in the band 5850-5875 MHz, at least until the effect on FSS uplinks has been completely analyzed to ensure that FSS service levels can be maintained.

In any such analysis, it is paramount that the Commission recognize that interference into an FSS uplink is the aggregate from the large number of unlicensed devices that are simultaneously transmitting within a satellite beam that can cover an area of thousands of square miles. In this respect, there is little that cognitive radios can do in terms of controlling this aggregate interference. These difficulties have been discussed in Section IV of the *Interference Temperature Comments*.

III. OPPORTUNITIES FOR AUTOMATED FREQUENCY COORDINATION BETWEEN SATELLITE EARTH STATIONS AND TERRESTRIAL STATIONS WILL BE VERY LIMITED

The *Notice* states that the use of cognitive radio "may offer opportunities for dynamically coordinated spectrum reuse." However, the Commission also recognizes that "prior coordination approaches are generally practical and lead to spectrally efficient use when sharing conditions do not change significantly over time." *Notice* at ¶ 69. The

Satellite Companies question whether the use of cognitive radio technology will offer any significant improvement for spectrum reuse between GSO FSS earth stations and terrestrial fixed services, since prior coordination already allows for measures to be taken by either party to ensure interference free operations.

The Commission recognizes that cognitive radio is efficient in the case of "different services that have unpredictable spectrum use patterns." *Notice* at ¶ 70. This implies that cognitive radio devices are not suitable for use in connection with GSO services since many transmissions are constant and their spectrum usage does not vary (e.g., broadcast signals that are on 24 hours per day and 365 days per year).

A. Full-Band, Full-Arc Coordination is Critical for Satellite Operators and Does Not Offer Much Potential For Automated Frequency Coordination

The *Notice* mentions "full band, full arc" coordination as a scenario that may offer opportunities for dynamically coordinated spectrum reuse. *Notice* at ¶ 69.

The Satellite Companies understand that the Commission is not questioning the need for "full band, full arc" coordination. In any case, the Satellite Companies would like to reiterate how critical this practice is for the operation of satellite communication systems. The Commission has previously addressed this matter.[2] In response to the FWCC's petition and a subsequent Notice of Proposed Rulemaking,[3] the Satellite Industry Association filed extensive comments documenting the numerous reasons why GSO FSS earth station licensees need the flexibility to reorient their earth stations,

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[2] Request for Declaratory Rulemaking and Petition for Rulemaking of the Fixed Wireless Communications Coalition, RM-9649 (May 5, 1999).

[3] IB Docket No. 00-203, FCC 00-369 (Oct. 24, 2000).

change points of communication, and change frequencies on short notice. Among other things, this flexibility is needed to "respond to changing customer requirements; restore service in the event of a facility failure; make adjustments to facilitate coordination with adjacent satellites; launch replacement satellites that take advantage of technological advances; and manage overall network capacity efficiently."[4]

The Commission denied the FWCC's petition, recognizing that "the FSS and FS have significantly different requirements for access to the electromagnetic spectrum in order to meet their business needs," and determining that there was an "absence of evidence … [that the] current rules have resulted in injury to the terrestrial fixed service community."[5]

With this background, the Satellite Companies would like to offer the following specific comments on the potential for using cognitive radios in the "full band, full arc" coordination scenario.

The Satellite Companies believe that the fact that earth stations may be pointing to different satellites at different points in time offers very little opportunity for spectrum reuse. Given typical earth station elevation angles and pointing directions of FS terrestrial antennas, in most cases FSS earth station receive interference from or cause interference to terrestrial stations via a far sidelobe of the earth station antenna.[6] As a

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[4] Comments of the Satellite Industry Association *et al.*, IB Docket No. 00-203 (Jan. 8, 2001) at ii.

[5] *Second Report and Order*, IB Docket No. 00-203, 17 FCC Rcd 2002, 2007 (2002).

[6] This is true both for GSO and non-GSO FSS systems given that the latter are designed to operate with a minimum earth station elevation angle and for most of the time will also operate with large elevation angles.

result, mutual interference is, in many cases, not dependent on the main-beam pointing of the earth station antenna.

In the downlink frequencies of a satellite system, the use of cognitive radios in the terrestrial system does not offer any real possibility for exploiting periods of time in which a given earth station is receiving less than "full-band". Since downlinks from visible satellites will most likely encompass the full-band, the cognitive radio cannot possibly determine which particular frequency bands are being received by a neighboring FSS earth station.

With respect to the uplink frequencies, a cognitive radio being used by a licensed FS terrestrial station could possibly sense the frequency bands being used at a given point in time by a transmit FSS earth station and select a different frequency band.[7]

B. Use of Cognitive Radio Techniques by Satellite Operators Would Impose Severe Financial Burdens that Cannot Be Justified By Any Marginal Spectral Efficiency Increase That Might Result

The Satellite Companies believe that the implementation of cognitive radios in an attempt to improve the sharing between GSO FSS earth stations and terrestrial fixed services (FS) terminals would increase incidents of interference into licensed FSS services and impose significant financial burdens on satellite operators.

As discussed in detail in a previous submission to the Commission "placing monitoring devices on spacecraft does not appear to be a viable option." *Interference Temperature Comments* at Section IV.A. There are also substantial obstacles to placing

[7] Note that this paragraph is addressing the specific case of licensed FS terrestrial stations. For unlicensed devices, as discussed in See Section II, the use of cognitive radios does not solve the problem of controlling the aggregate interference to FSS uplinks.

the measurement equipment at the receive earth station. As noted in the *Interference Temperature Comments*, many stations are quite small, and monitoring interference would require equipment that is significantly more complex than the terminal itself. Furthermore, there are millions of satellite receive terminals operating in the U.S., and deployment of the facilities for monitoring and disseminating interference information would be costly and time-consuming.

In addition to these financial obstacles, there are technical and enforcement issues that would have to be resolved before cognitive radios could be used. These are identified in detail in Sections IV.A and IV.B of the *Interference Temperature Comments*.

The Commission seeks comments on whether financial incentives would encourage dynamic coordination approaches. *Notice* at ¶ 73. The Satellite Companies are of the view that this would not be the case. For the reasons discussed above, the use of dynamic coordination would not lead to any significant improvement in the spectrum sharing efficiency between GSO FSS earth stations and licensed terrestrial stations (FS). Therefore, even with financial incentives, implementation of cognitive radios in satellite systems would be too expensive and technically too complex to become attractive.

The Commission also seeks comments on whether secondary market spectrum leasing could provide a framework for such financial incentives. *Notice* at ¶ 73. As mentioned above, spectrum usage for many GSO FSS services is relatively constant and seems to offer only limited possibilities for secondary market spectrum leasing. Further, the concept of secondary market spectrum leasing is better suited to situations where a single entity holds exclusive spectrum rights within a defined geographic area; in

contrast, geostationary satellite spectrum is licensed on a non-exclusive basis to operators re-using the spectrum with satellites spaced at two-degree intervals across the geostationary arc.

IV. CONCLUSION

As discussed above, the Satellite Companies oppose any power increase for operation in the band 5850-5875 MHz under Sections 15.247 and 15.249 of the rules, at least until its effect on FSS uplinks has been fully analyzed.

More generally, the Satellite Companies have serious concerns about the use of cognitive radios as a means to allow deployment of unlicensed devices in frequency bands allocated to satellite services. These concerns have been discussed in detail in a previous submission to the Commission (see *Interference Temperature Comments*) and are incorporated by reference here.

Moreover, the Satellite Companies believe that the implementation of cognitive radios aiming at dynamic coordinated spectrum sharing between GSO FSS and licensed terrestrial fixed (FS) does not offer the potential for any significant increase in spectrum efficiency.

Respectfully submitted,

GLOBALSTAR, L.P. By: */s/ William F. Adler* Vice President, Legal and Regulatory Affairs Globalstar, L.P. 3200 Zanker Road San Jose, CA 95134	ICO GLOBAL COMMUNICATIONS By: */s/ Suzanne Hutchings* Senior Regulatory Counsel ICO Global Communications 2000 Pennsylvania Ave., NW, Suite 4400 Washington, DC 20006
INTELSAT GLOBAL SERVICE CORPORATION By: */s/ Milenko Stojkovic* Director, Telecommunications Policy & Regulatory Affairs Intelsat Global Service Corporation 3400 International Drive, N.W. Washington, DC 20008	LORAL SPACE & COMMUNICATIONS LTD By: */s/ John P. Stern* Deputy General Counsel Loral Space & Communications Ltd 1755 Jefferson Davis Hwy, Suite 1007 Arlington, VA 22202
NEW SKIES SATELLITES By: */s/ Andrew R, D'Uve* Vice President and Associate General Counsel New Skies satellites Rooseveltplantsoen 4 2517 KR, The Hague The Netherlands	PANAMSAT CORPORATION By: */s/ Kalpak S. Gude* Vice President, Gov't & Regulatory Affairs and Associate General Counsel PanAmSat Corporation 1801 K Street, N.W., Suite 440 Washington, DC 20006
SES AMERICOM, INC. By: */s/ Nancy J. Eskenazi* Vice President & Assoc. Gen'l Counsel SES AMERICOM, Inc. 4 Research Way Princeton, NJ 08540	

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