

Before the  
**Federal Communications Commission**  
Washington, DC 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 SIRIUS SATELLITE RADIO INC. AND XM RADIO INC.**

Sirius Satellite Radio Inc. (“Sirius”) and XM Radio Inc. (“XM”) jointly comment on the Commission’s Notice of Proposed Rulemaking and Order (“*NPRM and Order*”) in the above-captioned proceedings.<sup>1</sup> The *NPRM and Order* proposes, *inter alia*, the use of cognitive radio technologies to enable (1) non-voluntary third party access to spectrum by permitting unlicensed devices to operate at times or in locations where licensed spectrum is not in use and (2) the use of higher power by unlicensed devices in rural or other areas of limited spectrum use.<sup>2</sup>

Sirius and XM are the two companies licensed by the Commission to operate and offer satellite digital audio radio service (“satellite DARS”). These two satellite DARS licensees

---

<sup>1</sup> *Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies Authorization and Use of Software Defined Radios*, Notice of Proposed Rulemaking and Order, FCC 03-322, 18 FCC Rcd 26859 (2003) (“*NPRM and Order*”), as noticed in *Cognitive Radio Technologies and Software Defined Radios*, 69 Fed. Reg. 7397 (Feb. 17, 2004) (proposed rule and comment/reply comment dates notice).

<sup>2</sup> *NPRM and Order*, ¶¶ 3, 5. The *NPRM and Order* is complementary to proceedings considering specific uses of cognitive radio technologies. *Id.* at note 4. For Sirius’ comments in the complementary interference temperature proceeding, see *Comments of Sirius Satellite Radio, Inc.*, ET Docket No. 03-237 (filed Apr. 5, 2004).

combined spent over \$ 4 billion to construct, launch and operate satellite constellations now in service. Sirius and XM already serve more than 2 million subscribers, with high current customer growth rates. Sirius, for example, provides continuous digital radio with over 100 audio channels, substantially augmenting the diversity and choice available to American consumers. As a result, satellite DARS licensees have dramatically reduced the disparity in access to radio to 45 million underserved consumers in the U.S., particularly those in rural areas.<sup>3</sup>

Sirius and XM take no position on cognitive radios in general, which operate solely on a secondary basis.<sup>4</sup> However, if applied to the 2320-2345 MHz satellite DARS spectrum, the proposed cognitive radio rules could undermine these important and highly demanded services, as well as the business of satellite DARS licensees. More precisely, signal energy from hypothetical unlicensed cognitive devices likely would interfere with DARS operations, constrain high-quality nationwide audio service and thus jeopardize the rapid deployment of satellite DARS envisioned by the Commission. The same might be true were cognitive radios allowed to operate in spectrum adjacent to the DARS band. This is because the agency's rationale—and tentative public interest findings, for expanded use of unlicensed cognitive radio devices—does not and could not apply to satellite DARS spectrum, for several reasons.

First, the proposed rules for the application of cognitive radio technology are inappropriate because satellite DARS providers are the sole licensed users of the 2320-2345 MHz band.<sup>5</sup>

---

<sup>3</sup> *Satellite CD Radio, Inc., Application for Authority to Construct, Launch, and Operate Two Satellites in the Satellite Digital Audio Radio Service*, Order and Authorization, 13 FCC Rcd 7971, 7971-72 (1997) (“*Sirius Order and Authorization*”), *aff'd on recons.*, 16 FCC Rcd 21458 (2001), *aff'd per curiam sub nom., Primosphere Ltd. P'shp v. FCC*, Nos. 01-1526, 01-1527 (D.C. Cir. Feb. 21, 2003).

<sup>4</sup> 47 U.S.C. § 15.5 (2003).

<sup>5</sup> 47 C.F.R. § 25.202(a)(6) (2003). Sirius is the exclusive licensee in 2320-2332.5 MHz; XM Radio is the exclusive licensee in 2332.5-2345 MHz.

Moreover, satellite DARS frequencies are “restricted” for purposes of Part 15, meaning unlicensed devices may not transmit in the band. Thus, the instant rulemaking—proposing unlicensed cognitive radios,<sup>6</sup> operating at six times the power ceiling now contained in Part 15,<sup>7</sup> simply is not applicable to the 2320-2345 MHz band.<sup>8</sup> Because no entity other than Sirius and XM may transmit in the satellite DARS band, the satellite DARS licensees presume that the new rules, if adopted, will not apply to spectrum at 2320-2345 MHz.

Second, were the satellite DARS band deleted from the restricted list, the proposed cognitive radio rules would afford insufficient protection to satellite DARS operations. The proposed methods to determine when spectrum is “unused” are ill suited to the spectrum occupied by satellite radio downlinks.<sup>9</sup> Satellite DARS is designed to provide constant, ubiquitous coverage over the entire co-terminus United States, without any “unused” spectrum in which cognitive radios could operate. Despite the required satellite DARS signal availability, cognitive radios are

---

<sup>6</sup> *NPRM and Order*, ¶ 36.

<sup>7</sup> *NPRM and Order*, ¶ 38. If a part 15 Device were permitted to operate in the satellite DARS band at the currently authorized power for part 15 devices in non-restricted bands, it would cause harmful interference over areas where many users may be located; transmitting at approximately 8 dB above the current level as proposed in the *NPRM and Order* would make the “kill” area 6 times larger.

<sup>8</sup> To the extent that the *NPRM and Order* contemplates permitting unlicensed intentional radiators to operate in spectrum adjacent to the satellite DARS band, the out-of band energy from such devices that is permitted in the satellite DARS band should not be allowed to exceed the out-of-band energy from licensed devices in adjacent bands that is permitted to fall within the satellite DARS band. *See* 47 C.F.R. § 27.53(a) (2003) (stating out-of-band emission requirements for WCS of  $110 + 10 \log(p)$  dB below transmitter power for mobile transmitters and  $80 + 10 \log(p)$  dB below transmitter power for fixed transmitters). The out-of-band emissions for cognitive radios should be limited to the same level as existing adjacent services whether the radio is transmitting at the currently authorized Part 15 power level or the 6 times that power level as proposed in the *NPRM and Order*.

<sup>9</sup> The Commission suggests “Spectrum sensing may be appropriate in bands for example, where services may transmit for long periods of time, e.g., broadcast type services, and sensing techniques would not need to be repeated frequently to be effective.” *NPRM and Order*, ¶ 24. But, satellite DARS spectrum falls outside the Commission’s implicit assumption, its coverage is not limited to a particular geographic area.

likely to see “false negatives”<sup>10</sup> for the following reasons. Sirius’ highly elliptical, non-geostationary orbiting satellites provide excellent ubiquitous and high-elevation angle coverage, but Sirius’ signal strength at any given location varies constantly, which could cause an unlicensed device falsely to assume it could transmit without harmful interference. Moreover, both satellite DARS licensees are subject to blockage, multi-path fading, and foliage attenuation, which similarly could generate “false negatives.” The interference potential of “false negatives” could be compounded by the Commission’s assumption that any sensing duty cycle could be relatively long yet still be effective.<sup>11</sup> In addition, the *NPRM and Order* provides no dispute resolution mechanism in the event the cognitive radios create actual interference to licensed services.<sup>12</sup>

In short, the proposed rules—if applied to the 2320-2345 MHz band—will endanger the provision of service to the rural users it is designed to benefit. Sirius and XM therefore suggest that the Commission reiterate its conclusion that unlicensed devices, including future cognitive radios, simply may not operate in the satellite DARS band.

---

<sup>10</sup> A “false negative” occurs where a cognitive radio senses that the spectrum is “unused”, *e.g.*, it is clear to transmit, when it is actually receiving a reduced signal, *i.e.*, from a Sirius satellite, due to a temporary condition such as orbital variation, blockage, multi-path fading, and foliage attenuation.

<sup>11</sup> *NPRM and Order*, ¶ 24. The longer the sensing interval, the longer the cognitive radio could transmit at six times the power presently permitted by Part 15 Rules in response to a “false negative”.

<sup>12</sup> Sirius and XM share the Commission’s concern “about the potential for parties to make unauthorized changes to software programmable radios after they are manufactured and first sold which could result in harmful interference to authorized services.” *NPRM and Order*, ¶ 84. Sirius and XM encourage the agency to impose mandatory regulation of software defined radios (SDRs) including strict anti-tampering measures to prevent end users from altering SDRs for unauthorized use in licensed spectrum bands. Moreover, to the extent that cognitive radios are capable of transmitting in the satellite DARS band they should not only incorporate digital frequency selection (DFS) to select the appropriate frequency based on the country of operation, *NPRM and Order*, ¶ 97, but also should transmit a unique identifier for the transmitter to identify the source of any interference caused by improper transmission in or adjacent to the satellite DARS band. It would be irresponsible for the Commission to move forward with the proposed rules without resolving the known risks posed by SDRs to licensed services.

Moreover, the FCC should carefully consider the potential for harmful interference should cognitive radios be permitted to operate in spectrum adjacent to satellite DARS. Unlicensed devices, including cognitive radios, are secondary, and must limit out-of-band emissions. Sirius and XM recommend that unlicensed devices operating in adjacent channels—whatever their maximum transmitter power—should be obliged to reduce out of band emissions no greater than the equivalent ceilings applicable to adjacent channel licensed transmitters.<sup>13</sup>

Respectfully submitted,

XM RADIO INC.

SIRIUS SATELLITE RADIO INC.

By: */s/ Lon C. Levin*

By: */s/ Patrick L. Donnelly*

Lon C. Levin  
Senior Vice President  
XM Radio Inc.  
1500 Eckington Place, NE  
Washington, DC 20002  
(202) 380-4000

Patrick L. Donnelly  
Executive Vice President  
1221 Avenue of the Americas  
New York, NY 10020  
(212) 584-5100

May 3, 2004

---

<sup>13</sup> 47 C.F.R. § 27.53(a) (2003).