

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

In the Matter of Request of )  
 )  
XM RADIO LLC ) Call Sign S2118  
 )  
For Special Temporary Authority to )  
Extend the XM-1 License Term and )  
Revise the Orbital Debris Mitigation Plan )

**REQUEST FOR EXTENSION AND MODIFICATION OF STA**

XM Radio LLC (“XM Radio”) respectfully requests a 180-day extension of the special temporary authority (“STA”) granted in File No. SAT-STA-20141017-00110,<sup>1</sup> which extended the XM-1 satellite’s license term and authorized relocating XM-1 to 39° W.L. +/- 0.1 degrees in preparation for its retirement. In addition, XM Radio herein seeks authority to remove XM-1 to a disposal orbit pursuant to a revised orbital debris mitigation plan that reflects a higher level of residual xenon. Grant of the requested authority will serve the public interest by facilitating the orderly retirement of XM-1 beginning in October 2015.

**Background**

XM-1 is currently positioned at 115.25° W.L. with a +/- 0.1 degree east-west stationkeeping tolerance, where it had been serving as an in-orbit spare.<sup>2</sup> As the Commission is aware, XM Radio began preparations for retirement of both XM-1 and XM-2 in 2013, working closely with both the International Bureau’s Satellite Division and Boeing Satellite Systems (“BSS”), the satellites’ manufacturer. XM Radio has explained that the retirement planning

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<sup>1</sup> See *XM Radio LLC*, Call Sign S2118, File No. SAT-STA-20141017-00110 (the “XM-1 Relocation STA”), grant-stamped Nov. 26, 2014.

<sup>2</sup> See *XM Radio LLC*, Call Sign S2118, File No. SAT-MOD-20101216-00262 (the “XM-1 Modification”), grant-stamped Mar. 8, 2011 (the “XM-1 Modification Grant”).

process was especially complex because XM-1 and XM-2 are the first satellites in the XM Radio fleet and the first spacecraft in the BSS 702 product line to be removed to a disposal orbit.<sup>3</sup> Furthermore, XM Radio has access to limited ground resources that are equipped to communicate with these satellites and have the tracking capabilities needed to support the satellite orbit raising and decommissioning process.<sup>4</sup>

XM Radio proposed to drift both XM-1 and XM-2 significantly eastward before beginning orbit-raising maneuvers in order to keep the satellites within range of its earth station network for a longer period during the decommissioning process. XM Radio advised the Commission that it would perform the necessary maneuvers for XM-2 first, and would start the drift of XM-1 eastward only after it had completed the orbit raising process for XM-2.<sup>5</sup> XM Radio explained that this sequencing would allow XM Radio to make any appropriate adjustments to the XM-1 plan based on the results of the XM-2 satellite decommissioning and would permit use of the same ground facilities to support the maneuvers of both satellites.<sup>6</sup>

Pursuant to Commission authority,<sup>7</sup> XM-2 was relocated to 27° W.L. and held there during venting of onboard propellant, and the satellite was subsequently raised to a disposal

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<sup>3</sup> XM-1 Relocation STA, Narrative at 1.

<sup>4</sup> *Id.* at 1-2.

<sup>5</sup> *Id.* at 2.

<sup>6</sup> *Id.*

<sup>7</sup> See *XM Radio LLC*, Call Sign S2119, File Nos. SAT-STA-20140204-00018, grant-stamped Mar. 28, 2014; SAT-STA-20140922-00103 (“XM-2 September STA Request”), grant-stamped Sept. 26, 2014 (“XM-2 September STA Grant”); and SAT-STA-20141017-00109, grant-stamped Oct. 23, 2014.

orbit last October.<sup>8</sup> XM Radio had originally planned to drift XM-1 to 27° W.L. as well, but lessons learned from the XM-2 drift led XM Radio to specify 39° W.L., rather than 27° W.L., as the location at which XM-1 will be prepared for orbit raising.<sup>9</sup>

Like XM-2, XM-1 has both a traditional liquid bi-propellant system that was used for initial orbit raising and an electric xenon ion propulsion system (“XIPS”) used for stationkeeping while in orbit. During the retirement process for XM-2, XM Radio found that the process of depleting the extra xenon on board the spacecraft was extremely time-consuming. In order to avoid significant delay in the schedule for raising XM-2 to a disposal orbit, XM Radio requested and received Commission authority to retire the satellite pursuant to a revised orbital debris mitigation plan reflecting higher predicted levels of residual xenon on the spacecraft at end of life.<sup>10</sup> The Commission approved the updated plan reflecting the higher xenon levels based on the practical obstacles to attempting to vent a greater proportion of the xenon, the public interest in removing a satellite from geostationary orbit when it can no longer perform its primary mission, and the fact that the other elements of the plan, including the proposed disposal orbit altitude, remained unchanged.<sup>11</sup>

With the XM-2 retirement complete, relocation of XM-1 in preparation for its orbit raising will begin within the next few months. XM Radio anticipates commencing the drift to 39° W.L. in mid-June 2015 when the required ground facilities to support the drift become available. Drift is expected to take two months. After the satellite arrives at 39° W.L., it will be

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<sup>8</sup> See Letter of Karis A. Hastings, Counsel for XM Radio LLC, to Marlene H. Dortch, Secretary, Federal Communications Commission, File No. SAT-STA-20141017-00109, dated Oct. 30, 2014.

<sup>9</sup> XM-1 Relocation STA, Narrative at 2-4.

<sup>10</sup> See XM-2 September STA Grant, ¶ 6.

<sup>11</sup> See *id.*

maintained there during venting of excess xenon and bi-propellant. In order to facilitate power management, orbit-raising will not commence until mid-October 2015, after the fall eclipse season ends.

### **Request for Extended Operating and Drift Authority**

XM Radio requests extension of the XM-1 Relocation STA for a further 180-day period. Grant of the requested extension of the XM-1 license authority will allow XM Radio to relocate the spacecraft eastward, vent excess propellant, and remove the satellite to a disposal orbit.

### **Revised Orbital Debris Mitigation Plan**

XM Radio seeks Commission authorization to proceed with the retirement of XM-1 pursuant to the updated orbital debris mitigation plan described herein to prevent significant delay in the planned retirement schedule. The designs of XM-1 and XM-2 are identical, and authorizing orbit raising of XM-1 under the modified plan is therefore consistent with the XM-2 September STA Grant.

As with XM-2, XM Radio had previously submitted information provided by BSS indicating that approximately 2.2 kg (2200 grams) of xenon would remain in each of the two xenon tanks onboard XM-1 at end of life.<sup>12</sup> Based on this data and given the fact that XM-1 was designed and launched prior to the Commission's adoption of its orbital debris mitigation requirements, the Commission granted XM Radio a waiver of the Section 25.283(c) requirements to vent excess propellant and relieve pressure vessels in connection with the

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<sup>12</sup> See Call Sign S2118, File No. SAT-MOD-20101216-00262, Technical Appendix at 4 (explaining that the xenon tanks are equipped with a regulator that prevents additional gas from being vented once the pressure falls below the set point of the regulator), grant-stamped Mar. 8, 2011.

residual xenon then expected to be on XM-1 at end of life.<sup>13</sup> XM Radio now projects instead that 18-22 kg of residual xenon will remain in each tank at end of life. Approving the revised plan with respect to residual xenon and granting an updated waiver of Section 25.283(c) would be in the public interest in light of the specific circumstances here.

The facts underlying the increased residual xenon estimate for XM-1 are identical to those described in the XM-2 September STA Request.<sup>14</sup> First, like XM-2, XM-1 is being retired early due to performance issues outside of XM Radio's control, and the shortened useful life of the satellite reduced the amount of xenon used during the satellite's operational lifetime, leading to a higher level of residual xenon at the beginning of the disposal process.

Furthermore, XM Radio's experience with XM-2 indicates that only a limited portion of the onboard xenon can be vented during XM-1's stay at 39° W.L. XM Radio found that reconfiguring the XIPs system between venting and use for regular stationkeeping maneuvers was much more complicated and time-consuming than anticipated, significantly reducing the time that could be spent venting the xenon each day.<sup>15</sup>

It is not possible to continue venting xenon after XM-1 is decommissioned. Again, reliable ground resources operating with the S- and X-band frequencies used by XM-1 and the tracking capabilities needed to support the orbit-raising maneuvers and decommissioning are extremely limited. As a result, once the orbit-raising begins, XM Radio will have a restricted window of time before the satellite's westward drift takes it beyond the range of the ground network. Decommissioning the satellite requires sending commands to drain the batteries and turn off all active units – steps that must be taken before the ground antennas lose contact with

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<sup>13</sup> See XM-1 Modification Grant, Attachment to Grant at 2, ¶ 6.

<sup>14</sup> XM-2 September STA Request, Narrative at 3-5.

<sup>15</sup> See *id.* at 3-4.

the satellite. Because opening the valves to the xenon tanks requires power, the valves will close and remain closed once the power to the satellite is terminated.<sup>16</sup>

Maintaining XM-1 at 39° W.L. to vent additional xenon before beginning orbit-raising maneuvers would materially delay the satellite's retirement. Rather than being able to commence the retirement process in mid-October as planned, XM Radio would have to put off the orbit-raising until mid-April of 2016, given the time needed to significantly reduce the xenon levels and the delay required by the spring eclipse season.

In order to maintain the current schedule to begin orbit raising this October, XM Radio seeks Commission authority to proceed under the revised orbital debris mitigation plan and requests a waiver of Section 25.283(c) to reflect the increased residual xenon. As XM Radio showed with respect to XM-2, the additional xenon does not increase the risk of orbital debris.<sup>17</sup> With 18-22 kg of xenon, the pressure in each tank will be 3.7-4.2 MPa assuming a temperature of 20° Celsius. This pressure represents a small fraction (12-14%) of the 30.1 MPa for which the tanks have been proof pressure tested and will drop further as the temperature on the spacecraft decreases following shut-down of its electrical systems. Because the xenon is inert, having the higher levels of residual xenon on board the spacecraft at its end of life should pose no risk of chemical energy release. Furthermore, the tanks are well shielded and will be isolated from any source of electrical energy. XM Radio emphasizes that nothing has changed with respect to XM Radio's plan to raise XM-1 to a disposal orbit at least 313 km above the geostationary arc, which is the altitude derived by application of the IADC standard.<sup>18</sup>

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<sup>16</sup> *See id.* at 4.

<sup>17</sup> *See id.* at 5.

<sup>18</sup> *See* Call Sign S2118, File No. SAT-AMD-20080129-00031, Amendment Narrative at 3-4, grant-stamped Feb. 14, 2008.

Under these circumstances, the public interest would be served by permitting retirement of XM-1 to go forward as requested herein, rather than requiring venting of additional xenon. Accordingly, XM Radio respectfully requests special temporary authority for a period of 180 days commencing on May 26, 2015, to extend the XM-1 license term and drift authority and to allow retirement of the satellite to proceed in accordance with the updated orbital debris mitigation plan discussed herein.

Respectfully submitted,

XM Radio LLC

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