S2118 SAT-STA-20150317-00011 IB2015000514
XM Radio LLC
XM-1

GRANTED*
International Bureau
*with conditions

File # SAT-STA-2015 0317-00011
Call Sign S2118 Grant Date 04/30/15
(or other identifier)
Term Dates 05/26/15 period of
From ~~04/30/15~~ To: 180 days
Approved: Stephen J. Duall
Chief, Satellite Policy Branch

Approved by OMB
3060–0678

Date & Time Filed: Mar 17 2015 4:44:18:176PM
File Number: SAT–STA–20150317–00011
Callsign:

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SPACE STATION SPECIAL TEMPORARY AUTHORITY

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APPLICANT INFORMATION

Enter a description of this application to identify it on the main menu:
XM–1 (S2118) Retirement STA Extension and Modification March 2015

1. Applicant

Name:	XM Radio LLC	**Phone Number:**	202–380–1383
DBA Name:		**Fax Number:**	202–380–4981
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City:	New York	**State:**	NY
Country:	USA	**Zipcode:**	10020 –
Attention:	James S Blitz		

XM Radio LLC
IBFS File No. SAT-STA-20150317-00011
Call Sign S2118

The application of XM Radio LLC (XM Radio) for special temporary authority, IBFS File No. SAT-STA-20150317-00011, is granted. Specifically, XM Radio is authorized, for a period of 180 days, commencing on May 26, 2015, to continue to conduct Telemetry, Tracking, and Command (TT&C) operations necessary to drift its Satellite Digital Audio Radio Service (SDARS) space station, XM-1 (Call Sign S2118), from its current orbital location of 115.25° W.L. to the 39.0° W.L. orbital location and to maintain it at that location with an east-west stationkeeping tolerance of +/- 0.1 degrees. XM Radio is authorized to conduct such TT&C operations using the following center frequencies: 2339.2 MHz, 2339.7 MHz, 2344.0 MHz, and 2344.5 MHz (space-to-Earth); 7049.0 MHz and 7074.0 MHz (Earth-to-space). Additionally, we grant XM Radio's request to operate beyond the current license term for the XM-1 space station during this 180-day period to allow XM Radio sufficient time to complete its planned maneuvers for XM-1 in preparation for the space station's removal to a disposal orbit.[1] All operations of the XM-1 space station must be in accordance with the technical specifications set forth in its application, XM-1's current authorization, the Commission's rules, and the conditions set forth below.

1. All operations under this grant of special temporary authority must be on an unprotected and non-harmful interference basis, i.e., XM Radio shall not cause harmful interference to, and must not claim protection from interference caused to it by, any other lawfully operating radiocommunication system.

2. In the event of any harmful interference as a result of the operations under this grant of special temporary authority, XM Radio must cease operations immediately upon notification of such interference and shall immediately inform the Commission, in writing, of such an event.

3. XM Radio must coordinate the operations of XM-1 with existing geostationary space stations to ensure that no unacceptable interference results from its operations during drift to the 39.0° W.L. orbital location.

4. XM Radio must operate only the TT&C frequencies on XM-1 during the space station's drift to and operations at the 39.0° W.L. orbital location.

5. The Commission's previous grant of XM Radio's request for a waiver of Section 25.210(j) of the Commission's rules, 47 C.F.R. § 25.210, to allow operation of XM-1 at 39.0° W.L. with an east-west stationkeeping tolerance of +/- 0.1 degrees instead of the +/- 0.05 degree tolerance required by the rule will continue to apply for purposes of this special temporary authority. See IBFS File No. SAT-STA-20141017-00110, granted Nov. 26, 2014. XM Radio was originally granted a waiver of Section 25.210(j) to permit XM-1 to operate with an east-west stationkeeping tolerance of +/- 0.1 degrees at 115.25° W.L. See IBFS File No. SAT-MOD-20101216-00262, granted Mar. 8, 2011. We grant this

[1] XM-1's authorization expired on May 31, 2014. XM Radio was previously granted special temporary authority for 180 days to perform these same maneuvers by drifting XM-1 to the 27.0° W.L. orbital position. *See* IBFS File No. SAT-STA-20140321-00033, granted Apr. 30, 2014. However, in light of the experience XM Radio gained while performing similar maneuvers for XM-1's companion space station, XM-2 (IBFS File No. SAT-STA-20140204-00018, granted Mar. 28, 2014), XM Radio proposed to drift XM-1 to 39° W.L, rather than 27° W.L., prior to commencing orbit raising maneuvers so that the westward drift of the space station that will occur during the planned orbit-raising maneuver will not take XM-1 out of the range of XM Radio's TT&C earth stations and thus lose control over the space station. *See* IBFS File No. SAT-STA-20141017-00110, granted Nov. 26, 2014, which also extended special temporary authority for 180 days to complete these orbit-raising maneuvers. XM-Radio now requests a 180-day extension of that grant, and additionally seeks authority to proceed with orbit-raising maneuvers pursuant to a revised orbital debris plan that is identical to the revised orbital debris plan proposed for the deorbit of its XM-2 space station. Narrative at 2-4. *See also* IBFS File No. SAT-STA-20140922-00103, granted Sept. 26, 2014, wherein XM-2's revised orbital debris plan is detailed. We note that XM-2 has completed its deorbit maneuvers. *See* Letter from Karis A. Hastings, Counsel for XM Radio LLC, to Marlene H. Dortch, Secretary, FCC, (dated Oct. 30, 2014), available in IBFS File No. SAT-STA-20141017-00109.

waiver for the same reasons as provided for the original grant at 115.25 W.L.

6. XM Radio's request for a further waiver of Section 25.283(c) to operate XM-1 under a revised orbital debris mitigation plan as outlined in its application is GRANTED. The orbital debris mitigation plan that was approved as part of XM-1's current authorization anticipated that 2.2 kilograms of xenon would remain in each of the two xenon tanks onboard XM-1 at end of life.2 In the instant application, XM Radio states that if plans proceed to raise XM-1 to a disposal orbit of 313 kilometers above geostationary orbit, the residual xenon remaining in the tanks would increase to 18-22 kg of xenon in each tank. This waiver grant is based upon the following findings:

a) Telemetry, tracking and command functions for XM-1 are conducted in the 2320-2345 GHz band. Due to geographic limitations on the frequency allocations in this band, its use for TT&C restricts the availability of earth stations to a limited geographic area and prevents conducting venting operations over a long term after the satellite is removed from orbit and begins to drift westward. Such operations, if used to fully vent the xenon tanks, would cover a particularly long period because the quantity of remaining xenon propellant is larger than anticipated due to early termination of the satellite's primary mission, which was caused by component failures unrelated to the propulsion system.

b) It is in the public interest to remove a satellite from the geostationary orbit when it is no longer capable of performing its primary mission.

c) There are no other changes to the orbital debris mitigation plan previously approved by the Commission.

d) This waiver is consistent with that granted to XM Radio for deorbit of the XM-2 space station, which is identical to the XM-1 space station.[3]

7. Any action taken or expense incurred as a result of operations pursuant to this grant of special temporary authority is at XM Radio's own risk.

8. This action is taken on delegated authority pursuant to 47 C.F.R. § 0.261 and is effective upon release. Petitions for reconsideration under 47 C.F.R. § 1.106 or applications for review under 47 C.F.R. § 1.115 may be filed within 30 days of the date of the Public Notice announcing this action.

FEDERAL COMMUNICATIONS COMMISSION
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File # SAT-STA-20150317-00011
Call Sign S2118 Grant Date 04/30/15
(or other identifier)
Term Dates period of
From ~~04/30/15~~ 05/26/15 To: 180 days
Approved: Stephen J. Duall
Stephen J. Duall
Chief, Satellite Policy Branch

[2] *See* IBFS File No. SAT-MOD-20101216-00262, granted Mar. 8, 2011, Technical Appendix at 4.

[3] *See* IBFS File No. SAT-STA-20140922-00103, granted Sept. 26, 2014.

2. Contact

Name:	Karis A. Hastings	**Phone Number:**	202–599–0975
Company:	SatCom Law LLC	**Fax Number:**	
Street:	1317 F Street, N.W.	**E–Mail:**	karis@satcomlaw.com
	Suite 400		
City:	Washington	**State:**	DC
Country:	USA	**Zipcode:**	20004 –
Attention:		**Relationship:**	Legal Counsel

(If your application is related to an application filed with the Commission, enter either the file number or the IB Submission ID of the related application. Please enter only one.)

3. Reference File Number SATSTA2014101700110 or Submission ID

4a. Is a fee submitted with this application?

◉ If Yes, complete and attach FCC Form 159. If No, indicate reason for fee exemption (see 47 C.F.R.Section 1.1114).

○ Governmental Entity ○ Noncommercial educational licensee

○ Other(please explain):

4b. Fee Classification CRY – Space Station (Geostationary)

5. Type Request

○ Change Station Location ◉ Extend Expiration Date ○ Other

6. Temporary Orbit Location	7. Requested Extended Expiration Date
	2015–11–26 00:00:00.0

8. Description (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

XM Radio LLC requests extension and modification of the special temporary authority it was granted in File No. SAT-STA-20141017-00110 to further extend the license term for the XM-1 (S2118) space station and permit retirement of the satellite pursuant to a revised orbital debris mitigation plan that reflects a higher level of residual xenon.

9. By checking Yes, the undersigned certifies that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti–Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes.

◉ Yes ○ No

10. Name of Person Signing	11. Title of Person Signing
James S. Blitz	Vice President, Regulatory Counsel

12. Please supply any need attachments.

Attachment 1: STA Narrative	Attachment 2:	Attachment 3:

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT (U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION (U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).

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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,[1] 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.[2] 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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[1] *See XM Radio LLC,* Call Sign S2118, File No. SAT-STA-20141017-00110 (the "XM-1 Relocation STA"), grant-stamped Nov. 26, 2014.

[2] *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.[3] 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.[4]

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.[5] 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.[6]

Pursuant to Commission authority,[7] 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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3 XM-1 Relocation STA, Narrative at 1.

4 *Id.* at 1-2.

5 *Id.* at 2.

6 *Id.*

7 *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.[8] 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.[9]

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.[10] 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.[11]

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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8 *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.

9 XM-1 Relocation STA, Narrative at 2-4.

10 *See* XM-2 September STA Grant, ¶ 6.

11 *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.[12] 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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[12] *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.[13] 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.[14] 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.[15]

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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13 *See* XM-1 Modification Grant, Attachment to Grant at 2, ¶ 6.

14 XM-2 September STA Request, Narrative at 3-5.

15 *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.[16]

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.[17] 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.[18]

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16 *See id.* at 4.

17 *See id.* at 5.

18 *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

/s/ James S. Blitz
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Dated: March 17, 2015

Technical Certification

I, Bridget Neville, Vice President and General Manager for Satellite Engineering and Operations of Sirius XM Radio Inc., hereby certify under penalty of perjury that:

I am the technically qualified person with overall responsibility for preparation of the technical information contained in the foregoing STA request. I am familiar with the technical requirements of Part 25 of the Commission's rules, and the information contained in the request is complete and accurate to the best of my knowledge, information and belief.

/s/
Bridget Neville

Dated: March 17, 2015