

## REQUEST FOR SPECIAL TEMPORARY AUTHORITY

Sirius XM Radio Inc. (“Sirius XM”) hereby requests special temporary authority (“STA”) for a period of sixty (60) days, commencing on or before December 20, 2019, to permit it to operate two new antennas at its Vernon, New Jersey earth station, call sign E080185,<sup>1</sup> in order to provide telemetry, tracking, and command (“TT&C”) for its Satellite Digital Audio Radio Service (“SDARS”) fleet. Sirius XM seeks STA pending submission of and Commission action on an application to modify the E080185 License to add these antennas and make other changes. Grant of the requested STA will serve the public interest by allowing Sirius XM to overcome interference issues and improve the reliability of its TT&C network, facilitating the safe operation of its SDARS spacecraft.

### Background

Sirius XM and its subsidiaries operate a network of SDARS space and earth stations that provide a wide variety of audio programming, including music, news, sports, weather, traffic, and foreign language offerings, to over 34 million Sirius XM subscribers. Sirius XM is modernizing the facilities used to perform TT&C and distribute programming by building several new antennas at its Vernon earth station. Sirius XM has prepared an application to modify the E080185 License to add these antennas and expects to file the application in mid-December once it receives the final coordination report. In the interim, Sirius XM seeks to begin using two of the new antennas to perform TT&C in order to address operational issues affecting other Sirius XM TT&C sites.

### STA Request

Sirius XM requests STA to commence TT&C operations with two new 7.3 meter antennas at Vernon, New Jersey. Information regarding the technical parameters of the proposed operations is provided in the tables below, and a radiation hazard analysis for the new antennas is attached.

<b>E29 Quantity</b>	<b>E30 Manufacturer.</b>	<b>E31 Model</b>	<b>E32 Antenna Size</b>	<b>E35 Height AGL</b>	<b>E36 Height Above Sea Level</b>	<b>E41/42 Antenna Gain</b>
2	Viasat	7.3m Torque Tube	7.3m	7.7m	136.3m	42.0 dBi at 2.326 GHz; 52.4 dBi at 7.050 GHz

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<sup>1</sup> Sirius XM Radio Inc., Call Sign E080185, File No. SES-MOD-20151222-00958, granted March 24, 2016 (the “E080185 License”).

<b>E43/44 Frequency Bands (MHz)</b>	<b>E45 T/R Mode</b>	<b>E46 Antenna Polarization</b>	<b>E47 Emission Designator</b>	<b>E48 Maximum EIRP per Carrier (dBW)</b>	<b>E49 Maximum EIRP Density Per Carrier (dBW/4 kHz)</b>
7040-7075	T	Left Hand Circular	800KF2D	84.8	61.8
2320-2345	R	Right Hand Circular	512KG1D	0	0

<b>E51 Satellite Orbit Type</b>	<b>E52/53 Frequency Limits (MHz)</b>	<b>E54/55 Range of Satellite Arc</b>	<b>E56 Earth Stn Az. Angle Eastern Limit</b>	<b>E56 Antenna Elev. Angle Eastern Limit</b>	<b>E57 Earth Stn Az. Angle Western Limit</b>	<b>E56 Antenna Elev. Angle Western Limit</b>	<b>E60 Max. EIRP Density toward the Horizon (dBW/4kHz)</b>
GSO	7025-7075	80W-120W	188.3	43.0	237.1	23.9	5.01

Public Interest Showing

Sirius XM has an urgent need to begin using the two new antennas described above to supplement its TT&C facilities in light of issues that have affected signal reliability. Specifically, TT&C operations at Sirius XM's Ellenwood, Georgia earth station have recently been disrupted by interference from multiple sources, one of which is Wireless Communications Service ("WCS") transmissions in spectrum adjacent to the SDARS downlink band. The interference was severe enough to overpower the telemetry carriers to the Ellenwood earth station from all satellites in the SDARS fleet, until a nearby WCS facility could be temporarily powered down. Interference continues to exist from an unknown source or sources, impairing the operation of this facility. Sirius XM plans to add filters at the Ellenwood site to reduce the interference levels, but the required filters must be custom built and will not be available for installation for at least four weeks.

As an interim solution, Sirius XM switched its primary TT&C operations to a facility in Canada. However, the Canadian antennas are roughly twenty years old, and their antenna control systems are no longer supported by the manufacturer.

Sirius XM seeks expedited authority to commence operations with the new antennas in Vernon, New Jersey, which are intended to replace the Canadian facilities. Use of the Vernon site will avoid the serious interference issues Sirius XM is encountering at the Ellenwood location. Sirius XM does not require an STA to receive telemetry transmissions using the new Vernon antennas. However, satellite operations are far easier when all telemetry, command, and ranging functions can be performed from a single station rather than switching between stations

for different functions. Sirius XM requires transmit authority for the Vernon antennas in order to perform all TT&C functions from the Vernon site.

Sirius XM emphasizes that the scope of this STA request is limited. Pending submission of and action on the application to modify the E080185 License, Sirius XM is seeking authority to use the two new antennas for TT&C functions only, using a limited range of transmit frequencies that have previously been coordinated at the Vernon site.

Grant of the requested STA is consistent with Commission policy and will not adversely affect other authorized operations. Coordination of the new antennas with other users of the proposed transmit frequencies is under way, and Sirius XM expects that it will be completed prior to the requested date for action on the STA.

Sirius XM understands that any Commission grant of this STA will be without prejudice to the ultimate determination the Commission will make regarding the application to modify the E080185 License. In addition, Sirius XM acknowledges that any action taken pursuant to a grant of the requested STA will be at Sirius XM's own risk.

## Analysis of Non-Ionizing Radiation for a 7.3-Meter Earth Station System

This report analyzes the non-ionizing radiation levels for a 7.3-meter earth station system. The analysis and calculations performed in this report comply with the methods described in the FCC Office of Engineering and Technology Bulletin, No. 65 first published in 1985 and revised in 1997 in Edition 97-01. The radiation safety limits used in the analysis are in conformance with the FCC R&O 96-326. Bulletin No. 65 and the FCC R&O specifies that there are two separate tiers of exposure limits that are dependant on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. The Maximum Permissible Exposure (MPE) limits for persons in a General Population/Uncontrolled environment are shown in Table 1. The General Population/Uncontrolled MPE is a function of transmit frequency and is for an exposure period of thirty minutes or less. The MPE limits for persons in an Occupational/Controlled environment are shown in Table 2. The Occupational MPE is a function of transmit frequency and is for an exposure period of six minutes or less. The purpose of the analysis described in this report is to determine the power flux density levels of the earth station in the far-field, near-field, transition region, between the subreflector or feed and main reflector surface, at the main reflector surface, and between the antenna edge and the ground and to compare these levels to the specified MPEs.

Table 1. Limits for General Population/Uncontrolled Exposure (MPE)

Frequency Range (MHz)	Power Density (mW/cm <sup>2</sup> )
30-300	0.2
300-1500	Frequency (MHz)*(0.8/1200)
1500-100,000	1.0

Table 2. Limits for Occupational/Controlled Exposure (MPE)

Frequency Range (MHz)	Power Density (mW/cm <sup>2</sup> )
30-300	1.0
300-1500	Frequency (MHz)*(4.0/1200)
1500-100,000	5.0

Table 3. Formulas and Parameters Used for Determining Power Flux Densities

Parameter	Symbol	Formula	Value	Units
Antenna Diameter	D	Input	7.3	m
Antenna Surface Area	A <sub>surface</sub>	$\pi D^2 / 4$	41.85	m <sup>2</sup>
Subreflector Diameter	D <sub>sr</sub>	Input	105.0	cm
Area of Subreflector	A <sub>sr</sub>	$\pi D_{sr}^2 / 4$	8659.01	cm <sup>2</sup>
Frequency	F	Input	7050	MHz
Wavelength	$\lambda$	300 / F	0.042553	m
Transmit Power	P	Input	1743.00	W
Antenna Gain (dBi)	G <sub>es</sub>	Input	52.4	dBi
Antenna Gain (factor)	G	10 <sup>G<sub>es</sub>/10</sup>	173780.1	n/a
Pi	$\pi$	Constant	3.1415927	n/a
Antenna Efficiency	$\eta$	$G\lambda^2/(\pi^2D^2)$	0.60	n/a

## 1. Far Field Distance Calculation

The distance to the beginning of the far field can be determined from the following equation:

$$\begin{aligned} \text{Distance to the Far Field Region} \quad R_{ff} &= 0.60 D^2 / \lambda \\ &= 751.4 \text{ m} \end{aligned} \quad (1)$$

The maximum main beam power density in the far field can be determined from the following equation:

$$\begin{aligned} \text{On-Axis Power Density in the Far Field} \quad S_{ff} &= G P / (4 \pi R_{ff}^2) \\ &= 42.693 \text{ W/m}^2 \\ &= 4.269 \text{ mW/cm}^2 \end{aligned} \quad (2)$$

## 2. Near Field Calculation

Power flux density is considered to be at a maximum value throughout the entire length of the defined Near Field region. The region is contained within a cylindrical volume having the same diameter as the antenna. Past the boundary of the Near Field region, the power density from the antenna decreases linearly with respect to increasing distance.

The distance to the end of the Near Field can be determined from the following equation:

$$\begin{aligned} \text{Extent of the Near Field} \quad R_{nf} &= D^2 / (4 \lambda) \\ &= 313.1 \text{ m} \end{aligned} \quad (3)$$

The maximum power density in the Near Field can be determined from the following equation:

$$\begin{aligned} \text{Near Field Power Density} \quad S_{nf} &= 16.0 \eta P / (\pi D^2) \\ &= 99.665 \text{ W/m}^2 \\ &= 9.966 \text{ mW/cm}^2 \end{aligned} \quad (4)$$

## 3. Transition Region Calculation

The Transition region is located between the Near and Far Field regions. The power density begins to decrease linearly with increasing distance in the Transition region. While the power density decreases inversely with distance in the Transition region, the power density decreases inversely with the square of the distance in the Far Field region. The maximum power density in the Transition region will not exceed that calculated for the Near Field region. The power density calculated in Section 1 is the highest power density the antenna can produce in any of the regions away from the antenna. The power density at a distance  $R_t$  can be determined from the following equation:

$$\begin{aligned} \text{Transition Region Power Density} \quad S_t &= S_{nf} R_{nf} / R_t \\ &= 9.966 \text{ mW/cm}^2 \end{aligned} \quad (5)$$

#### 4. Region between the Main Reflector and the Subreflector

Transmissions from the feed assembly are directed toward the subreflector surface, and are reflected back toward the main reflector. The most common feed assemblies are waveguide flanges, horns or subreflectors. The energy between the subreflector and the reflector surfaces can be calculated by determining the power density at the subreflector surface. This can be determined from the following equation:

$$\begin{aligned} \text{Power Density at the Subreflector} \quad S_{sr} &= 4000 P / A_{sr} & (6) \\ &= 805.172 \text{ mW/cm}^2 \end{aligned}$$

#### 5. Main Reflector Region

The power density in the main reflector is determined in the same manner as the power density at the subreflector. The area is now the area of the main reflector aperture and can be determined from the following equation:

$$\begin{aligned} \text{Power Density at the Main Reflector Surface} \quad S_{\text{surface}} &= 4 P / A_{\text{surface}} & (7) \\ &= 166.580 \text{ W/m}^2 \\ &= 16.658 \text{ mW/cm}^2 \end{aligned}$$

#### 6. Region between the Main Reflector and the Ground

Assuming uniform illumination of the reflector surface, the power density between the antenna and the ground can be determined from the following equation:

$$\begin{aligned} \text{Power Density between Reflector and Ground} \quad S_g &= P / A_{\text{surface}} & (8) \\ &= 41.645 \text{ W/m}^2 \\ &= 4.164 \text{ mW/cm}^2 \end{aligned}$$

## 7. Summary of Calculations

Table 4. Summary of Expected Radiation levels for Uncontrolled Environment

<b>Region</b>	<b>Calculated Maximum Radiation Power Density Level (mW/cm<sup>2</sup>)</b>		<b>Hazard Assessment</b>
1. Far Field ( $R_{ff} = 751.4$ m)	$S_{ff}$	4.269	Potential Hazard
2. Near Field ( $R_{nf} = 313.1$ m)	$S_{nf}$	9.966	Potential Hazard
3. Transition Region ( $R_{nf} < R_t < R_{ff}$ )	$S_t$	9.966	Potential Hazard
4. Between Main Reflector and Subreflector	$S_{sr}$	805.172	Potential Hazard
5. Main Reflector	$S_{surface}$	16.658	Potential Hazard
6. Between Main Reflector and Ground	$S_g$	4.164	Potential Hazard

Table 5. Summary of Expected Radiation levels for Controlled Environment

<b>Region</b>	<b>Calculated Maximum Radiation Power Density Level (mW/cm<sup>2</sup>)</b>		<b>Hazard Assessment</b>
1. Far Field ( $R_{ff} = 751.4$ m)	$S_{ff}$	4.269	Satisfies FCC MPE
2. Near Field ( $R_{nf} = 313.1$ m)	$S_{nf}$	9.966	Potential Hazard
3. Transition Region ( $R_{nf} < R_t < R_{ff}$ )	$S_t$	9.966	Potential Hazard
4. Between Main Reflector and Subreflector	$S_{sr}$	805.172	Potential Hazard
5. Main Reflector	$S_{surface}$	16.658	Potential Hazard
6. Between Main Reflector and Ground	$S_g$	4.164	Satisfies FCC MPE

It is the applicant's responsibility to ensure that the public and operational personnel are not exposed to harmful levels of radiation.

## 8. Conclusions

Based on the above analysis it is concluded that the FCC MPE guidelines have been exceeded (or met) in the regions of Table 4 and 5. The applicant proposes to comply with the MPE limits by one or more of the following methods.

Radiation hazard signs will be posted while this earth station is in operation.

Due to the remote and secure location of the proposed earth station antenna at the Vernon Teleport, the area of operation around the antenna will be limited to those that have knowledge of the potential for radiation exposure. The applicant will ensure that no buildings or other obstacles will be in the areas that exceed the MPE levels.

## Radiation Hazard Report

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### Means of Compliance Controlled Areas

The earth station's operational staff will not have access to the areas that exceed the MPE levels while the earth station is in operation.

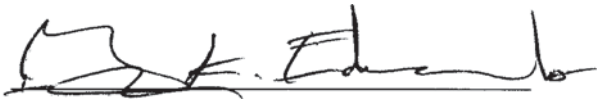
The transmitters will be turned off during antenna maintenance

The applicant agrees to abide by the conditions specified in Condition 5208 provided below:

*Condition 5208 - The licensee shall take all necessary measures to ensure that the antenna does not create potential exposure of humans to radiofrequency radiation in excess of the FCC exposure limits defined in 47 CFR 1.1307(b) and 1.1310 wherever such exposures might occur. Measures must be taken to ensure compliance with limits for both occupational/controlled exposure and for general population/uncontrolled exposure, as defined in these rule sections. Compliance can be accomplished in most cases by appropriate restrictions such as fencing. Requirements for restrictions can be determined by predictions based on calculations, modeling or by field measurements. The FCC's OET Bulletin 65 (available on-line at [www.fcc.gov/oet/rfsafety](http://www.fcc.gov/oet/rfsafety)) provides information on predicting exposure levels and on methods for ensuring compliance, including the use of warning and alerting signs and protective equipment for worker.*

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE RADIATION HAZARD REPORT, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY: \_



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