

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Space Exploration Holdings
CONRAD, MT
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
March 22, 2019

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1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated 02/21/2019.

Company

3 Rivers Communications
AC BidCO LLC
AT&T Mobility Spectrum LLC - ID, MT, WY
AT&T Mobility Spectrum-MN/IA/ND/NE/MT/SD
Big Sky Internet, Inc.
Blackfoot Communications, Inc.
Centric Internet Services
Cowles Montana Media (KHQ, Inc.)
Gallatin County 911 Communications
Gallatin Wireless Internet, LLC
Global Net, Inc.
Gold Creek Cellular of Montana LP
Granite County Sheriffs Department
Grizzly Broadband, LLC
Hellfire, LLC
Jefferson, County of
Lewis & Clark County
Lewis and Clark County Sheriff's Office
Little Apple Technologies, LLC
Missoula, City of
Montana Internet Corporation
Montana State University
Montana West
MontanaSky Networks, Inc.
New Cingular Wireless PCS LLC - Montana
NorthWestern Corporation
Omnicom Paging Plus LLC
Qwest Corporation
RF Wave LLC
Rocky Mountain Internet Inc
Ronan Telephone Co
SpeedConnect, LLC
Sprint Spectrum L.P.
State of Montana
T-Mobile License LLC
The University of Montana
Trouser, LLC
Truphone, Inc
Verizon Wireless (VAW) LLC -CO/ID/MT/WY
Vision Net, Inc

4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 <http://www.comsearch.com>

Date: 03/22/2019
Job Number: 190221COMSGE08

Administrative Information

Status ENGINEER PROPOSAL
Call Sign
Licensee Code SPACEX
Licensee Name Space Exploration Holdings

Site Information

CONRAD, MT
Venue Name
Latitude (NAD 83) 48° 12' 11.9" N
Longitude (NAD 83) 111° 56' 43.0" W
Climate Zone A
Rain Zone 5
Ground Elevation (AMSL) 1058.97 m / 3474.3 ft

Link Information

Satellite Type Low Earth Orbit
Mode TR - Transmit-Receive
Modulation Digital
Minimum Elevation Angle 25.0°
Azimuth Range 0.0° to 360°
Antenna Centerline (AGL) 0.91 m / 3.0 ft

Antenna Information

Receive - FCC32
Manufacturer Cobham
Model MK3 series
Gain / Diameter 39.3 dBi / 1.0 m
3-dB / 15-dB Beamwidth 1.50° / 3.40°

Transmit - FCC32

Cobham
MK3 series
40.1 dBi / 1.0 m
1.20° / 2.80°

Max Available RF Power (dBW/4 kHz)
(dBW/MHz)

-1.2
22.8

Maximum EIRP (dBW/4 kHz)
(dBW/MHz)

38.9
62.9

Interference Objectives: Long Term -156.0 dBW/MHz 20%
Short Term -146.0 dBW/MHz 0.01%

-151.0 dBW/4 kHz 20%
-128.0 dBW/4 kHz 0.0025%

Frequency Information

Receive 11.0 GHz
Emission / Frequency Range (MHz) 240MD7W / 10700.0 - 12700.0

Transmit 14.0 GHz

62M5D7W - 240MD7W / 14000.0 - 14500.0

Max Great Circle Coordination Distance 265.5 km / 165.0 mi
Precipitation Scatter Contour Radius 355.1 km / 220.6 mi

202.3 km / 125.7 mi
100.0 km / 62.1 mi

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Coordination Values

CONRAD, MT

| | | | | |
|------------------------------------|----------------------------|-------------------|------------------|---------|
| Licensee Name | Space Exploration Holdings | | | |
| Latitude (NAD 83) | 48° 12' 11.9" N | | | |
| Longitude (NAD 83) | 111° 56' 43.0" W | | | |
| Ground Elevation (AMSL) | 1058.97 m / 3474.3 ft | | | |
| Antenna Centerline (AGL) | 0.91 m / 3.0 ft | | | |
| Antenna Model | Cobham 1 meter | | | |
| Antenna Mode | Receive 11.0 GHz | Transmit 14.0 GHz | | |
| Interference Objectives: Long Term | -156.0 dBW/MHz | 20% | -151.0 dBW/4 kHz | 20% |
| Short Term | -146.0 dBW/MHz | 0.01% | -128.0 dBW/4 kHz | 0.0025% |
| Max Available RF Power | | | -1.2 (dBW/4 kHz) | |

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 11.0 GHz | | Transmit 14.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 0.00 | 74.58 | -5.50 | 265.50 | -5.50 | 202.30 |
| 5 | 0.00 | 70.00 | -5.50 | 265.50 | -5.50 | 202.30 |
| 10 | 0.00 | 65.45 | -5.50 | 265.50 | -5.50 | 202.30 |
| 15 | 0.00 | 60.93 | -5.50 | 265.50 | -5.50 | 202.30 |
| 20 | 0.00 | 56.46 | -5.50 | 265.50 | -5.50 | 202.30 |
| 25 | 0.00 | 52.05 | -5.50 | 265.50 | -5.50 | 202.30 |
| 30 | 0.00 | 47.72 | -5.50 | 265.50 | -5.50 | 202.30 |
| 35 | 0.00 | 43.50 | -5.50 | 265.50 | -5.50 | 202.30 |
| 40 | 0.00 | 39.42 | -5.50 | 265.50 | -5.50 | 202.30 |
| 45 | 0.00 | 35.53 | -5.50 | 265.50 | -5.50 | 202.30 |
| 50 | 0.00 | 31.91 | -5.50 | 265.50 | -5.50 | 202.30 |
| 55 | 0.00 | 28.66 | -5.50 | 265.50 | -5.50 | 202.30 |
| 60 | 0.00 | 25.92 | -5.50 | 265.50 | -5.50 | 202.30 |
| 65 | 0.00 | 23.86 | -5.50 | 265.50 | -5.50 | 202.30 |
| 70 | 0.00 | 22.69 | -5.50 | 265.50 | -5.50 | 202.30 |
| 75 | 0.00 | 22.52 | -5.50 | 265.50 | -5.50 | 202.30 |
| 80 | 0.00 | 23.39 | -5.50 | 265.50 | -5.50 | 202.30 |
| 85 | 0.00 | 25.19 | -5.50 | 265.50 | -5.50 | 202.30 |
| 90 | 0.00 | 27.74 | -5.50 | 265.50 | -5.50 | 202.30 |
| 95 | 0.00 | 30.84 | -5.50 | 265.50 | -5.50 | 202.30 |
| 100 | 0.00 | 34.36 | -5.50 | 265.50 | -5.50 | 202.30 |
| 105 | 0.00 | 38.17 | -5.50 | 265.50 | -5.50 | 202.30 |
| 110 | 0.00 | 42.20 | -5.50 | 265.50 | -5.50 | 202.30 |
| 115 | 0.00 | 46.38 | -5.50 | 265.50 | -5.50 | 202.30 |
| 120 | 0.00 | 50.68 | -5.50 | 265.50 | -5.50 | 202.30 |
| 125 | 0.00 | 55.07 | -5.50 | 265.50 | -5.50 | 202.30 |
| 130 | 0.00 | 59.52 | -5.50 | 265.50 | -5.50 | 202.30 |
| 135 | 0.00 | 64.03 | -5.50 | 265.50 | -5.50 | 202.30 |
| 140 | 0.00 | 68.57 | -5.50 | 265.50 | -5.50 | 202.30 |
| 145 | 0.00 | 73.15 | -5.50 | 265.50 | -5.50 | 202.30 |
| 150 | 0.00 | 77.74 | -5.50 | 265.50 | -5.50 | 202.30 |
| 155 | 0.00 | 82.35 | -5.50 | 265.50 | -5.50 | 202.30 |
| 160 | 0.00 | 86.97 | -5.50 | 265.50 | -5.50 | 202.30 |
| 165 | 0.00 | 91.59 | -5.50 | 265.50 | -5.50 | 202.30 |
| 170 | 0.00 | 96.20 | -5.50 | 265.50 | -5.50 | 202.30 |
| 175 | 0.00 | 100.82 | -5.50 | 265.50 | -5.50 | 202.30 |
| 180 | 0.00 | 105.42 | -5.50 | 265.50 | -5.50 | 202.30 |
| 185 | 0.00 | 110.00 | -5.50 | 265.50 | -5.50 | 202.30 |

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Coordination Values

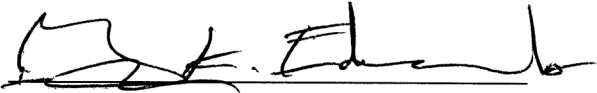
CONRAD, MT

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| Antenna Model | Cobham 1 meter | | |
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| Interference Objectives: | Long Term | -156.0 dBW/MHz 20% | -151.0 dBW/4 kHz 20% |
| | Short Term | -146.0 dBW/MHz 0.01% | -128.0 dBW/4 kHz 0.0025% |
| Max Available RF Power | -1.2 (dBW/4 kHz) | | |

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 11.0 GHz | | Transmit 14.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 0.00 | 114.55 | -5.50 | 265.50 | -5.50 | 202.30 |
| 195 | 0.00 | 119.07 | -5.50 | 265.50 | -5.50 | 202.30 |
| 200 | 0.00 | 123.54 | -5.50 | 265.50 | -5.50 | 202.30 |
| 205 | 0.00 | 127.95 | -5.50 | 265.50 | -5.50 | 202.30 |
| 210 | 0.00 | 132.28 | -5.50 | 265.50 | -5.50 | 202.30 |
| 215 | 0.00 | 136.50 | -5.50 | 265.50 | -5.50 | 202.30 |
| 220 | 0.00 | 140.58 | -5.50 | 265.50 | -5.50 | 202.30 |
| 225 | 0.00 | 144.47 | -5.50 | 265.50 | -5.50 | 202.30 |
| 230 | 0.00 | 148.09 | -5.50 | 265.50 | -5.50 | 202.30 |
| 235 | 0.00 | 151.34 | -5.50 | 265.50 | -5.50 | 202.30 |
| 240 | 0.00 | 154.08 | -5.50 | 265.50 | -5.50 | 202.30 |
| 245 | 0.00 | 156.14 | -5.50 | 265.50 | -5.50 | 202.30 |
| 250 | 0.00 | 157.31 | -5.50 | 265.50 | -5.50 | 202.30 |
| 255 | 0.00 | 157.48 | -5.50 | 265.50 | -5.50 | 202.30 |
| 260 | 0.00 | 156.61 | -5.50 | 265.50 | -5.50 | 202.30 |
| 265 | 0.00 | 154.81 | -5.50 | 265.50 | -5.50 | 202.30 |
| 270 | 0.00 | 152.26 | -5.50 | 265.50 | -5.50 | 202.30 |
| 275 | 0.00 | 149.16 | -5.50 | 265.50 | -5.50 | 202.30 |
| 280 | 0.00 | 145.64 | -5.50 | 265.50 | -5.50 | 202.30 |
| 285 | 0.00 | 141.83 | -5.50 | 265.50 | -5.50 | 202.30 |
| 290 | 0.00 | 137.80 | -5.50 | 265.50 | -5.50 | 202.30 |
| 295 | 0.00 | 133.62 | -5.50 | 265.50 | -5.50 | 202.30 |
| 300 | 0.00 | 129.32 | -5.50 | 265.50 | -5.50 | 202.30 |
| 305 | 0.00 | 124.93 | -5.50 | 265.50 | -5.50 | 202.30 |
| 310 | 0.00 | 120.48 | -5.50 | 265.50 | -5.50 | 202.30 |
| 315 | 0.00 | 115.97 | -5.50 | 265.50 | -5.50 | 202.30 |
| 320 | 0.00 | 111.43 | -5.50 | 265.50 | -5.50 | 202.30 |
| 325 | 0.00 | 106.85 | -5.50 | 265.50 | -5.50 | 202.30 |
| 330 | 0.00 | 102.26 | -5.50 | 265.50 | -5.50 | 202.30 |
| 335 | 0.00 | 97.65 | -5.50 | 265.50 | -5.50 | 202.30 |
| 340 | 0.00 | 93.03 | -5.50 | 265.50 | -5.50 | 202.30 |
| 345 | 0.00 | 88.41 | -5.50 | 265.50 | -5.50 | 202.30 |
| 350 | 0.00 | 83.80 | -5.50 | 265.50 | -5.50 | 202.30 |
| 355 | 0.00 | 79.18 | -5.50 | 265.50 | -5.50 | 202.30 |

5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY:  _____

Gary K. Edwards
Senior Manager
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: March 22, 2019