

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Comcast Cable Communications, LLC
LITTLETON, CO
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
August 02, 2018

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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 08/02/2018.

Company

CableLabs

Qwest Corporation

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: 08/02/2018
Job Number: 180802COMSJE04

Administrative Information

Status ENGINEER PROPOSAL
Call Sign
Licensee Code ZCATEC
Licensee Name Comcast Cable Communications, LLC

Site Information

LITTLETON, CO
Venue Name
Latitude (NAD 83) 39° 30' 52.0" N
Longitude (NAD 83) 105° 1' 30.0" W
Climate Zone A
Rain Zone 2
Ground Elevation (AMSL) 1688.13 m / 5538.5 ft

Link Information

Satellite Type Geostationary
Mode RO - Receive-Only
Modulation Digital
Satellite Arc 60° W to 143° West Longitude
Azimuth Range 122.4° to 230.8°
Corresponding Elevation Angles 25.2° / 29.9°
Antenna Centerline (AGL) 5.49 m / 18.0 ft

Antenna Information

Receive - A40917
Manufacturer ANDREW CORPORATION
Model ESA91-4
Gain / Diameter 50.7 dBi / 9.1 m
3-dB / 15-dB Beamwidth 0.50° / 1.00°

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

Frequency Information

Receive 4.0 GHz
Emission / Frequency Range (MHz) 36M0G7W / 3700.0 - 4200.0

Max Great Circle Coordination Distance 297.2 km / 184.6 mi
Precipitation Scatter Contour Radius 495.2 km / 307.7 mi

COMSEARCH

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Antenna Model Andrew Corporation ESA91-4
Antenna Mode Receive 4.0 GHz
Interference Objectives: Long Term -156.0 dBW/MHz 20%
Short Term -146.0 dBW/MHz 0.01%

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|--------------------------|-------------------------------|-----------------------|-------------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 1.45 | 119.42 | -14.95 | 186.66 |
| 5 | 1.77 | 115.03 | -12.32 | 189.78 |
| 10 | 2.27 | 110.59 | -10.54 | 185.88 |
| 15 | 2.71 | 106.09 | -10.30 | 176.67 |
| 20 | 3.10 | 101.52 | -10.30 | 165.84 |
| 25 | 3.47 | 96.92 | -10.30 | 157.56 |
| 30 | 3.82 | 92.28 | -10.30 | 150.07 |
| 35 | 4.00 | 87.62 | -10.30 | 146.56 |
| 40 | 4.14 | 82.95 | -10.30 | 144.37 |
| 45 | 4.24 | 78.29 | -10.30 | 142.95 |
| 50 | 4.28 | 73.64 | -10.30 | 142.35 |
| 55 | 4.27 | 69.01 | -10.30 | 142.51 |
| 60 | 4.41 | 64.37 | -10.30 | 140.40 |
| 65 | 4.54 | 59.76 | -10.30 | 138.56 |
| 70 | 4.37 | 55.27 | -10.30 | 141.03 |
| 75 | 4.24 | 50.83 | -10.30 | 142.94 |
| 80 | 3.61 | 46.67 | -8.97 | 161.08 |
| 85 | 3.11 | 42.63 | -7.35 | 182.50 |
| 90 | 2.72 | 38.75 | -6.05 | 197.31 |
| 95 | 3.01 | 34.73 | -5.19 | 195.38 |
| 100 | 3.42 | 30.86 | -3.65 | 194.53 |
| 105 | 3.54 | 27.53 | -2.31 | 198.80 |
| 110 | 3.15 | 25.15 | -1.36 | 209.18 |
| 115 | 2.91 | 23.42 | -0.67 | 218.19 |
| 120 | 2.50 | 22.80 | -0.42 | 229.41 |
| 125 | 2.16 | 23.15 | -0.56 | 237.25 |
| 130 | 1.80 | 24.50 | -1.10 | 244.80 |
| 135 | 1.41 | 26.71 | -1.98 | 252.87 |
| 140 | 1.04 | 29.53 | -3.11 | 258.79 |
| 145 | 0.95 | 32.46 | -4.29 | 255.83 |
| 150 | 0.52 | 35.46 | -5.39 | 276.84 |
| 155 | 0.32 | 38.01 | -5.90 | 297.17 |
| 160 | 0.52 | 39.88 | -6.28 | 271.47 |
| 165 | 0.76 | 41.31 | -6.82 | 251.95 |
| 170 | 0.91 | 42.37 | -7.25 | 240.26 |
| 175 | 1.22 | 42.81 | -7.42 | 226.74 |
| 180 | 1.17 | 43.10 | -7.54 | 227.65 |
| 185 | 1.36 | 42.67 | -7.37 | 222.59 |

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Antenna Model Andrew Corporation ESA91-4
Antenna Mode Receive 4.0 GHz
Interference Objectives: Long Term -156.0 dBW/MHz 20%
Short Term -146.0 dBW/MHz 0.01%

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 1.38 | 41.92 | -7.07 | 223.48 |
| 195 | 1.47 | 40.65 | -6.56 | 223.53 |
| 200 | 1.40 | 39.10 | -6.12 | 228.06 |
| 205 | 1.21 | 37.26 | -5.75 | 236.48 |
| 210 | 1.17 | 34.94 | -5.28 | 240.53 |
| 215 | 1.24 | 32.43 | -4.27 | 244.28 |
| 220 | 1.17 | 30.56 | -3.52 | 251.47 |
| 225 | 1.13 | 29.32 | -3.03 | 256.03 |
| 230 | 1.06 | 28.87 | -2.85 | 259.82 |
| 235 | 1.14 | 29.06 | -2.92 | 256.34 |
| 240 | 1.12 | 30.12 | -3.35 | 254.50 |
| 245 | 0.95 | 31.99 | -4.10 | 257.30 |
| 250 | 0.88 | 34.34 | -5.04 | 255.34 |
| 255 | 0.88 | 37.10 | -5.72 | 251.08 |
| 260 | 0.76 | 40.33 | -6.43 | 254.64 |
| 265 | 0.93 | 43.65 | -7.76 | 236.33 |
| 270 | 1.06 | 47.25 | -9.20 | 222.43 |
| 275 | 1.29 | 51.00 | -10.30 | 210.24 |
| 280 | 1.21 | 55.03 | -10.30 | 212.55 |
| 285 | 0.39 | 59.39 | -10.30 | 260.12 |
| 290 | 0.29 | 63.56 | -10.30 | 272.09 |
| 295 | 0.00 | 67.83 | -10.30 | 283.38 |
| 300 | 0.00 | 72.06 | -10.30 | 283.38 |
| 305 | 0.00 | 76.34 | -10.30 | 283.38 |
| 310 | 0.00 | 80.64 | -10.30 | 283.38 |
| 315 | 0.00 | 84.96 | -10.30 | 283.38 |
| 320 | 0.00 | 89.30 | -10.30 | 283.38 |
| 325 | 0.00 | 93.63 | -10.30 | 283.38 |
| 330 | 0.00 | 97.95 | -10.30 | 283.38 |
| 335 | 0.00 | 102.26 | -10.30 | 283.38 |
| 340 | 0.23 | 106.59 | -10.30 | 280.03 |
| 345 | 0.51 | 110.91 | -10.66 | 244.99 |
| 350 | 0.92 | 115.25 | -12.45 | 212.62 |
| 355 | 1.27 | 119.54 | -15.03 | 191.69 |

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: _____

Jennifer Lokey
Coordinator III, Data
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: August 02, 2018

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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 08/02/2018.

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

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Date: 08/02/2018
Job Number: 180802COMSJE08

Administrative Information

Status ENGINEER PROPOSAL
Call Sign
Licensee Code ZCATEC
Licensee Name Comcast Cable Communications, LLC

Site Information

LITTLETON, CO
Venue Name
Latitude (NAD 83) 39° 30' 52.0" N
Longitude (NAD 83) 105° 1' 30.0" W
Climate Zone A
Rain Zone 2
Ground Elevation (AMSL) 1688.13 m / 5538.5 ft

Link Information

Satellite Type Geostationary
Mode RO - Receive-Only
Modulation Digital
Satellite Arc 60° W to 143° West Longitude
Azimuth Range 122.4° to 230.8°
Corresponding Elevation Angles 25.2° / 29.9°
Antenna Centerline (AGL) 2.74 m / 9.0 ft

Antenna Information

Manufacturer VIKING
Model VS-SSE45FAE
Gain / Diameter 43.6 dBi / 4.5 m
3-dB / 15-dB Beamwidth 1.20° / 2.60°

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

Frequency Information

Receive 4.0 GHz
Emission / Frequency Range (MHz) 36M0G7W / 3700.0 - 4200.0

Max Great Circle Coordination Distance 285.3 km / 177.2 mi
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| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 1.59 | 119.45 | -10.00 | 205.58 |
| 5 | 2.00 | 115.07 | -10.00 | 194.57 |
| 10 | 2.54 | 110.64 | -10.00 | 182.05 |
| 15 | 2.99 | 106.12 | -10.00 | 171.68 |
| 20 | 3.38 | 101.54 | -10.00 | 161.00 |
| 25 | 3.74 | 96.93 | -10.00 | 153.09 |
| 30 | 4.10 | 92.28 | -10.00 | 146.34 |
| 35 | 4.28 | 87.62 | -10.00 | 143.66 |
| 40 | 4.42 | 82.94 | -10.00 | 141.55 |
| 45 | 4.52 | 78.27 | -10.00 | 140.19 |
| 50 | 4.56 | 73.60 | -10.00 | 139.61 |
| 55 | 4.55 | 68.97 | -10.00 | 139.76 |
| 60 | 4.78 | 64.31 | -10.00 | 136.48 |
| 65 | 4.91 | 59.68 | -10.00 | 134.75 |
| 70 | 4.65 | 55.20 | -10.00 | 138.35 |
| 75 | 4.52 | 50.74 | -10.00 | 140.18 |
| 80 | 3.83 | 46.59 | -9.71 | 152.72 |
| 85 | 3.27 | 42.56 | -8.73 | 171.86 |
| 90 | 2.85 | 38.68 | -7.69 | 186.56 |
| 95 | 3.17 | 34.64 | -6.49 | 185.45 |
| 100 | 3.60 | 30.74 | -5.19 | 182.63 |
| 105 | 3.72 | 27.39 | -3.94 | 186.58 |
| 110 | 3.33 | 24.99 | -2.94 | 199.84 |
| 115 | 3.05 | 23.29 | -2.18 | 207.08 |
| 120 | 2.66 | 22.64 | -1.87 | 217.19 |
| 125 | 2.29 | 23.02 | -2.05 | 225.08 |
| 130 | 1.87 | 24.43 | -2.70 | 232.52 |
| 135 | 1.48 | 26.65 | -3.64 | 239.75 |
| 140 | 1.06 | 29.51 | -4.75 | 247.49 |
| 145 | 0.97 | 32.45 | -5.78 | 245.16 |
| 150 | 0.55 | 35.44 | -6.74 | 266.60 |
| 155 | 0.41 | 37.93 | -7.48 | 275.27 |
| 160 | 0.54 | 39.86 | -8.01 | 259.18 |
| 165 | 0.80 | 41.28 | -8.39 | 240.52 |
| 170 | 0.94 | 42.35 | -8.67 | 230.75 |
| 175 | 1.24 | 42.78 | -8.78 | 218.86 |
| 180 | 1.20 | 43.07 | -8.85 | 219.84 |
| 185 | 1.38 | 42.64 | -8.75 | 214.80 |

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Antenna Mode Receive 4.0 GHz
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Short Term -146.0 dBW/MHz 0.01%

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 1.41 | 41.89 | -8.55 | 215.01 |
| 195 | 1.50 | 40.62 | -8.22 | 214.07 |
| 200 | 1.44 | 39.06 | -7.79 | 217.97 |
| 205 | 1.25 | 37.22 | -7.27 | 226.61 |
| 210 | 1.21 | 34.90 | -6.57 | 231.59 |
| 215 | 1.26 | 32.41 | -5.77 | 234.70 |
| 220 | 1.24 | 30.49 | -5.10 | 239.03 |
| 225 | 1.20 | 29.26 | -4.66 | 243.34 |
| 230 | 1.13 | 28.80 | -4.49 | 246.73 |
| 235 | 1.22 | 28.99 | -4.55 | 243.29 |
| 240 | 1.20 | 30.04 | -4.94 | 241.61 |
| 245 | 1.03 | 31.91 | -5.60 | 243.43 |
| 250 | 0.96 | 34.27 | -6.37 | 242.18 |
| 255 | 0.96 | 37.05 | -7.22 | 237.59 |
| 260 | 0.83 | 40.28 | -8.13 | 239.84 |
| 265 | 0.95 | 43.64 | -9.00 | 228.33 |
| 270 | 1.08 | 47.24 | -9.86 | 218.42 |
| 275 | 1.31 | 50.99 | -10.00 | 211.04 |
| 280 | 1.23 | 55.02 | -10.00 | 213.40 |
| 285 | 0.44 | 59.38 | -10.00 | 256.99 |
| 290 | 0.38 | 63.53 | -10.00 | 262.89 |
| 295 | 0.26 | 67.77 | -10.00 | 277.69 |
| 300 | 0.00 | 72.06 | -10.00 | 285.28 |
| 305 | 0.00 | 76.34 | -10.00 | 285.28 |
| 310 | 0.00 | 80.64 | -10.00 | 285.28 |
| 315 | 0.00 | 84.96 | -10.00 | 285.28 |
| 320 | 0.00 | 89.30 | -10.00 | 285.28 |
| 325 | 0.00 | 93.63 | -10.00 | 285.28 |
| 330 | 0.00 | 97.95 | -10.00 | 285.28 |
| 335 | 0.00 | 102.26 | -10.00 | 285.28 |
| 340 | 0.29 | 106.60 | -10.00 | 274.63 |
| 345 | 0.58 | 110.93 | -10.00 | 244.35 |
| 350 | 1.00 | 115.27 | -10.00 | 220.48 |
| 355 | 1.35 | 119.57 | -10.00 | 209.69 |

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Licensee Name Comcast Cable Communications, LLC

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Modulation Digital
Satellite Arc 60° W to 143° West Longitude
Azimuth Range 122.4° to 230.8°
Corresponding Elevation Angles 25.2° / 29.9°
Antenna Centerline (AGL) 2.74 m / 9.0 ft

Antenna Information

Manufacturer VIASAT
Model 8010D
Gain / Diameter 47.7 dBi / 7.0 m
3-dB / 15-dB Beamwidth 0.70° / 1.30°

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

Frequency Information

Receive 4.0 GHz
Emission / Frequency Range (MHz) 36M0G7W / 3700.0 - 4200.0

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|-------------|-----------------------|----------------------------|--------------------|----------------------------|
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| 5 | 2.00 | 115.07 | -10.00 | 194.57 |
| 10 | 2.54 | 110.64 | -10.00 | 182.05 |
| 15 | 2.99 | 106.12 | -10.00 | 171.68 |
| 20 | 3.38 | 101.54 | -10.00 | 161.00 |
| 25 | 3.74 | 96.93 | -10.00 | 153.09 |
| 30 | 4.10 | 92.28 | -10.00 | 146.34 |
| 35 | 4.28 | 87.62 | -10.00 | 143.66 |
| 40 | 4.42 | 82.94 | -10.00 | 141.55 |
| 45 | 4.52 | 78.27 | -10.00 | 140.19 |
| 50 | 4.56 | 73.60 | -10.00 | 139.61 |
| 55 | 4.55 | 68.97 | -10.00 | 139.76 |
| 60 | 4.78 | 64.31 | -10.00 | 136.48 |
| 65 | 4.91 | 59.68 | -10.00 | 134.75 |
| 70 | 4.65 | 55.20 | -10.00 | 138.35 |
| 75 | 4.52 | 50.74 | -10.00 | 140.18 |
| 80 | 3.83 | 46.59 | -9.71 | 152.72 |
| 85 | 3.27 | 42.56 | -8.73 | 171.86 |
| 90 | 2.85 | 38.68 | -7.69 | 186.56 |
| 95 | 3.17 | 34.64 | -6.49 | 185.45 |
| 100 | 3.60 | 30.74 | -5.19 | 182.63 |
| 105 | 3.72 | 27.39 | -3.94 | 186.58 |
| 110 | 3.33 | 24.99 | -2.94 | 199.84 |
| 115 | 3.05 | 23.29 | -2.18 | 207.08 |
| 120 | 2.66 | 22.64 | -1.87 | 217.19 |
| 125 | 2.29 | 23.02 | -2.05 | 225.08 |
| 130 | 1.87 | 24.43 | -2.70 | 232.52 |
| 135 | 1.48 | 26.65 | -3.64 | 239.75 |
| 140 | 1.06 | 29.51 | -4.75 | 247.49 |
| 145 | 0.97 | 32.45 | -5.78 | 245.16 |
| 150 | 0.55 | 35.44 | -6.74 | 266.60 |
| 155 | 0.41 | 37.93 | -7.48 | 275.27 |
| 160 | 0.54 | 39.86 | -8.01 | 259.18 |
| 165 | 0.80 | 41.28 | -8.39 | 240.52 |
| 170 | 0.94 | 42.35 | -8.67 | 230.75 |
| 175 | 1.24 | 42.78 | -8.78 | 218.86 |
| 180 | 1.20 | 43.07 | -8.85 | 219.84 |
| 185 | 1.38 | 42.64 | -8.75 | 214.80 |

COMSEARCH

Earth Station Data Sheet

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

Coordination Values

LITTLETON, CO

Licensee Name Comcast Cable Communications, LLC
Latitude (NAD 83) 39° 30' 52.0" N
Longitude (NAD 83) 105° 1' 30.0" W
Ground Elevation (AMSL) 1688.13 m / 5538.5 ft
Antenna Centerline (AGL) 2.74 m / 9.0 ft
Antenna Model VIASAT 8010D
Antenna Mode Receive 4.0 GHz
Interference Objectives: Long Term -156.0 dBW/MHz 20%
Short Term -146.0 dBW/MHz 0.01%

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 1.41 | 41.89 | -8.55 | 215.01 |
| 195 | 1.50 | 40.62 | -8.22 | 214.07 |
| 200 | 1.44 | 39.06 | -7.79 | 217.97 |
| 205 | 1.25 | 37.22 | -7.27 | 226.61 |
| 210 | 1.21 | 34.90 | -6.57 | 231.59 |
| 215 | 1.26 | 32.41 | -5.77 | 234.70 |
| 220 | 1.24 | 30.49 | -5.10 | 239.03 |
| 225 | 1.20 | 29.26 | -4.66 | 243.34 |
| 230 | 1.13 | 28.80 | -4.49 | 246.73 |
| 235 | 1.22 | 28.99 | -4.55 | 243.29 |
| 240 | 1.20 | 30.04 | -4.94 | 241.61 |
| 245 | 1.03 | 31.91 | -5.60 | 243.43 |
| 250 | 0.96 | 34.27 | -6.37 | 242.18 |
| 255 | 0.96 | 37.05 | -7.22 | 237.59 |
| 260 | 0.83 | 40.28 | -8.13 | 239.84 |
| 265 | 0.95 | 43.64 | -9.00 | 228.33 |
| 270 | 1.08 | 47.24 | -9.86 | 218.42 |
| 275 | 1.31 | 50.99 | -10.00 | 211.04 |
| 280 | 1.23 | 55.02 | -10.00 | 213.40 |
| 285 | 0.44 | 59.38 | -10.00 | 256.99 |
| 290 | 0.38 | 63.53 | -10.00 | 262.89 |
| 295 | 0.26 | 67.77 | -10.00 | 277.69 |
| 300 | 0.00 | 72.06 | -10.00 | 285.28 |
| 305 | 0.00 | 76.34 | -10.00 | 285.28 |
| 310 | 0.00 | 80.64 | -10.00 | 285.28 |
| 315 | 0.00 | 84.96 | -10.00 | 285.28 |
| 320 | 0.00 | 89.30 | -10.00 | 285.28 |
| 325 | 0.00 | 93.63 | -10.00 | 285.28 |
| 330 | 0.00 | 97.95 | -10.00 | 285.28 |
| 335 | 0.00 | 102.26 | -10.00 | 285.28 |
| 340 | 0.29 | 106.60 | -10.00 | 274.63 |
| 345 | 0.58 | 110.93 | -10.00 | 244.35 |
| 350 | 1.00 | 115.27 | -10.00 | 220.48 |
| 355 | 1.35 | 119.57 | -10.00 | 209.69 |

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: _____

Jennifer Lokey
Coordinator III, Data
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: August 02, 2018

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Comcast Cable Communications, LLC
LITTLETON, CO
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
August 02, 2018

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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 08/02/2018.

Company

CableLabs

Qwest Corporation

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: 08/02/2018
Job Number: 180802COMSJE06

Administrative Information

Status ENGINEER PROPOSAL
Call Sign
Licensee Code ZCATEC
Licensee Name Comcast Cable Communications, LLC

Site Information

LITTLETON, CO
Venue Name
Latitude (NAD 83) 39° 30' 52.0" N
Longitude (NAD 83) 105° 1' 30.0" W
Climate Zone A
Rain Zone 2
Ground Elevation (AMSL) 1688.13 m / 5538.5 ft

Link Information

Satellite Type Geostationary
Mode RO - Receive-Only
Modulation Digital
Satellite Arc 60° W to 143° West Longitude
Azimuth Range 122.4° to 230.8°
Corresponding Elevation Angles 25.2° / 29.9°
Antenna Centerline (AGL) 2.74 m / 9.0 ft

Antenna Information

Manufacturer Patriot
Model 4.5M Prime
Gain / Diameter 43.3 dBi / 4.5 m
3-dB / 15-dB Beamwidth 1.20° / 2.50°

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

Frequency Information

Receive 4.0 GHz
Emission / Frequency Range (MHz) 36M0G7W / 3700.0 - 4200.0

Max Great Circle Coordination Distance 285.3 km / 177.2 mi
Precipitation Scatter Contour Radius 495.2 km / 307.7 mi

COMSEARCH

Earth Station Data Sheet

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

Coordination Values

LITTLETON, CO

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Antenna Centerline (AGL) 2.74 m / 9.0 ft
Antenna Model Patriot 4.5M Prime
Antenna Mode Receive 4.0 GHz
Interference Objectives: Long Term -156.0 dBW/MHz 20%
Short Term -146.0 dBW/MHz 0.01%

| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 1.59 | 119.45 | -10.00 | 205.58 |
| 5 | 2.00 | 115.07 | -10.00 | 194.57 |
| 10 | 2.54 | 110.64 | -10.00 | 182.05 |
| 15 | 2.99 | 106.12 | -10.00 | 171.68 |
| 20 | 3.38 | 101.54 | -10.00 | 161.00 |
| 25 | 3.74 | 96.93 | -10.00 | 153.09 |
| 30 | 4.10 | 92.28 | -10.00 | 146.34 |
| 35 | 4.28 | 87.62 | -10.00 | 143.66 |
| 40 | 4.42 | 82.94 | -10.00 | 141.55 |
| 45 | 4.52 | 78.27 | -10.00 | 140.19 |
| 50 | 4.56 | 73.60 | -10.00 | 139.61 |
| 55 | 4.55 | 68.97 | -10.00 | 139.76 |
| 60 | 4.78 | 64.31 | -10.00 | 136.48 |
| 65 | 4.91 | 59.68 | -10.00 | 134.75 |
| 70 | 4.65 | 55.20 | -10.00 | 138.35 |
| 75 | 4.52 | 50.74 | -10.00 | 140.18 |
| 80 | 3.83 | 46.59 | -9.71 | 152.72 |
| 85 | 3.27 | 42.56 | -8.73 | 171.86 |
| 90 | 2.85 | 38.68 | -7.69 | 186.56 |
| 95 | 3.17 | 34.64 | -6.49 | 185.45 |
| 100 | 3.60 | 30.74 | -5.19 | 182.63 |
| 105 | 3.72 | 27.39 | -3.94 | 186.58 |
| 110 | 3.33 | 24.99 | -2.94 | 199.84 |
| 115 | 3.05 | 23.29 | -2.18 | 207.08 |
| 120 | 2.66 | 22.64 | -1.87 | 217.19 |
| 125 | 2.29 | 23.02 | -2.05 | 225.08 |
| 130 | 1.87 | 24.43 | -2.70 | 232.52 |
| 135 | 1.48 | 26.65 | -3.64 | 239.75 |
| 140 | 1.06 | 29.51 | -4.75 | 247.49 |
| 145 | 0.97 | 32.45 | -5.78 | 245.16 |
| 150 | 0.55 | 35.44 | -6.74 | 266.60 |
| 155 | 0.41 | 37.93 | -7.48 | 275.27 |
| 160 | 0.54 | 39.86 | -8.01 | 259.18 |
| 165 | 0.80 | 41.28 | -8.39 | 240.52 |
| 170 | 0.94 | 42.35 | -8.67 | 230.75 |
| 175 | 1.24 | 42.78 | -8.78 | 218.86 |
| 180 | 1.20 | 43.07 | -8.85 | 219.84 |
| 185 | 1.38 | 42.64 | -8.75 | 214.80 |

COMSEARCH

Earth Station Data Sheet

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Antenna Mode Receive 4.0 GHz
Interference Objectives: Long Term -156.0 dBW/MHz 20%
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| Azimuth (°) | Horizon Elevation (°) | Antenna Discrimination (°) | Receive 4.0 GHz | |
|-------------|-----------------------|----------------------------|--------------------|----------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 190 | 1.41 | 41.89 | -8.55 | 215.01 |
| 195 | 1.50 | 40.62 | -8.22 | 214.07 |
| 200 | 1.44 | 39.06 | -7.79 | 217.97 |
| 205 | 1.25 | 37.22 | -7.27 | 226.61 |
| 210 | 1.21 | 34.90 | -6.57 | 231.59 |
| 215 | 1.26 | 32.41 | -5.77 | 234.70 |
| 220 | 1.24 | 30.49 | -5.10 | 239.03 |
| 225 | 1.20 | 29.26 | -4.66 | 243.34 |
| 230 | 1.13 | 28.80 | -4.49 | 246.73 |
| 235 | 1.22 | 28.99 | -4.55 | 243.29 |
| 240 | 1.20 | 30.04 | -4.94 | 241.61 |
| 245 | 1.03 | 31.91 | -5.60 | 243.43 |
| 250 | 0.96 | 34.27 | -6.37 | 242.18 |
| 255 | 0.96 | 37.05 | -7.22 | 237.59 |
| 260 | 0.83 | 40.28 | -8.13 | 239.84 |
| 265 | 0.95 | 43.64 | -9.00 | 228.33 |
| 270 | 1.08 | 47.24 | -9.86 | 218.42 |
| 275 | 1.31 | 50.99 | -10.00 | 211.04 |
| 280 | 1.23 | 55.02 | -10.00 | 213.40 |
| 285 | 0.44 | 59.38 | -10.00 | 256.99 |
| 290 | 0.38 | 63.53 | -10.00 | 262.89 |
| 295 | 0.26 | 67.77 | -10.00 | 277.69 |
| 300 | 0.00 | 72.06 | -10.00 | 285.28 |
| 305 | 0.00 | 76.34 | -10.00 | 285.28 |
| 310 | 0.00 | 80.64 | -10.00 | 285.28 |
| 315 | 0.00 | 84.96 | -10.00 | 285.28 |
| 320 | 0.00 | 89.30 | -10.00 | 285.28 |
| 325 | 0.00 | 93.63 | -10.00 | 285.28 |
| 330 | 0.00 | 97.95 | -10.00 | 285.28 |
| 335 | 0.00 | 102.26 | -10.00 | 285.28 |
| 340 | 0.29 | 106.60 | -10.00 | 274.63 |
| 345 | 0.58 | 110.93 | -10.00 | 244.35 |
| 350 | 1.00 | 115.27 | -10.00 | 220.48 |
| 355 | 1.35 | 119.57 | -10.00 | 209.69 |

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BY: _____

Jennifer Lokey
Coordinator III, Data
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147

DATED: August 02, 2018

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Comcast Cable Communications, LLC
LITTLETON, CO
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Prepared By:
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1. CONCLUSIONS

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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.

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Earth Station Data Sheet

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

Date: 08/02/2018
Job Number: 180802COMSJE05

Administrative Information

Status ENGINEER PROPOSAL
Call Sign
Licensee Code ZCATEC
Licensee Name Comcast Cable Communications, LLC

Site Information

LITTLETON, CO
Venue Name
Latitude (NAD 83) 39° 30' 52.0" N
Longitude (NAD 83) 105° 1' 30.0" W
Climate Zone A
Rain Zone 2
Ground Elevation (AMSL) 1688.13 m / 5538.5 ft

Link Information

Satellite Type Geostationary
Mode RO - Receive-Only
Modulation Digital
Satellite Arc 60° W to 143° West Longitude
Azimuth Range 122.4° to 230.8°
Corresponding Elevation Angles 25.2° / 29.9°
Antenna Centerline (AGL) 2.74 m / 9.0 ft

Antenna Information

Manufacturer Andrew
Model ES76K-1
Gain / Diameter 48.3 dBi / 7.3 m
3-dB / 15-dB Beamwidth 0.66° / 1.30°

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

Frequency Information

Receive 4.0 GHz
Emission / Frequency Range (MHz) 36M0G7W / 3700.0 - 4200.0

Max Great Circle Coordination Distance 285.3 km / 177.2 mi
Precipitation Scatter Contour Radius 495.2 km / 307.7 mi

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|-------------|--------------------------|-------------------------------|-----------------------|-------------------------------|
| | | | Horizon Gain (dBi) | Coordination Distance (km) |
| 0 | 1.59 | 119.45 | -10.00 | 205.58 |
| 5 | 2.00 | 115.07 | -10.00 | 194.57 |
| 10 | 2.54 | 110.64 | -10.00 | 182.05 |
| 15 | 2.99 | 106.12 | -10.00 | 171.68 |
| 20 | 3.38 | 101.54 | -10.00 | 161.00 |
| 25 | 3.74 | 96.93 | -10.00 | 153.09 |
| 30 | 4.10 | 92.28 | -10.00 | 146.34 |
| 35 | 4.28 | 87.62 | -10.00 | 143.66 |
| 40 | 4.42 | 82.94 | -10.00 | 141.55 |
| 45 | 4.52 | 78.27 | -10.00 | 140.19 |
| 50 | 4.56 | 73.60 | -10.00 | 139.61 |
| 55 | 4.55 | 68.97 | -10.00 | 139.76 |
| 60 | 4.78 | 64.31 | -10.00 | 136.48 |
| 65 | 4.91 | 59.68 | -10.00 | 134.75 |
| 70 | 4.65 | 55.20 | -10.00 | 138.35 |
| 75 | 4.52 | 50.74 | -10.00 | 140.18 |
| 80 | 3.83 | 46.59 | -9.71 | 152.72 |
| 85 | 3.27 | 42.56 | -8.73 | 171.86 |
| 90 | 2.85 | 38.68 | -7.69 | 186.56 |
| 95 | 3.17 | 34.64 | -6.49 | 185.45 |
| 100 | 3.60 | 30.74 | -5.19 | 182.63 |
| 105 | 3.72 | 27.39 | -3.94 | 186.58 |
| 110 | 3.33 | 24.99 | -2.94 | 199.84 |
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|-------------|-----------------------|----------------------------|--------------------|----------------------------|
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| 210 | 1.21 | 34.90 | -6.57 | 231.59 |
| 215 | 1.26 | 32.41 | -5.77 | 234.70 |
| 220 | 1.24 | 30.49 | -5.10 | 239.03 |
| 225 | 1.20 | 29.26 | -4.66 | 243.34 |
| 230 | 1.13 | 28.80 | -4.49 | 246.73 |
| 235 | 1.22 | 28.99 | -4.55 | 243.29 |
| 240 | 1.20 | 30.04 | -4.94 | 241.61 |
| 245 | 1.03 | 31.91 | -5.60 | 243.43 |
| 250 | 0.96 | 34.27 | -6.37 | 242.18 |
| 255 | 0.96 | 37.05 | -7.22 | 237.59 |
| 260 | 0.83 | 40.28 | -8.13 | 239.84 |
| 265 | 0.95 | 43.64 | -9.00 | 228.33 |
| 270 | 1.08 | 47.24 | -9.86 | 218.42 |
| 275 | 1.31 | 50.99 | -10.00 | 211.04 |
| 280 | 1.23 | 55.02 | -10.00 | 213.40 |
| 285 | 0.44 | 59.38 | -10.00 | 256.99 |
| 290 | 0.38 | 63.53 | -10.00 | 262.89 |
| 295 | 0.26 | 67.77 | -10.00 | 277.69 |
| 300 | 0.00 | 72.06 | -10.00 | 285.28 |
| 305 | 0.00 | 76.34 | -10.00 | 285.28 |
| 310 | 0.00 | 80.64 | -10.00 | 285.28 |
| 315 | 0.00 | 84.96 | -10.00 | 285.28 |
| 320 | 0.00 | 89.30 | -10.00 | 285.28 |
| 325 | 0.00 | 93.63 | -10.00 | 285.28 |
| 330 | 0.00 | 97.95 | -10.00 | 285.28 |
| 335 | 0.00 | 102.26 | -10.00 | 285.28 |
| 340 | 0.29 | 106.60 | -10.00 | 274.63 |
| 345 | 0.58 | 110.93 | -10.00 | 244.35 |
| 350 | 1.00 | 115.27 | -10.00 | 220.48 |
| 355 | 1.35 | 119.57 | -10.00 | 209.69 |

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