

Ka-Band Earth Station – Kalama, WA

Frequency Coordination Report

28 GHz



Prepared on Behalf of
SPACE EXPLORATION
HOLDINGS

February 4, 2020



COMSEARCH
A CommScope Company

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1. Summary of Results

On behalf of SPACE EXPLORATION HOLDINGS, Comsearch performed a coordination notice under Section 25.203(c) and Section 25.136(a)(4) of the FCC’s rules for all existing and proposed terrestrial licenses within the coordination contours of their proposed Ka-Band earth station in Kalama, WA, which will transmit at 28 GHz¹. Prior-notification letters were sent to the licensees and a copy of the notification data is provided in section four of this report. The earth station coordination was finalized on February 3, 2020.

No objections were received from any of the incumbent 28 GHz licensees.

2. 28 GHz Common Carrier and LTTS Coordination

In accordance with FCC Rules and Regulations, the Ka-Band earth station in Kalama, WA was prior-coordinated by Comsearch. A notification letter and datasheets for this earth station were sent to the following 28 GHz common carrier fixed microwave licensees. These licensees are authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a nationwide basis or local basis.

Licensee	Authorized Geographic Area
Frontier Southwest Incorporated	Nationwide

A notification letter and datasheets for the Ka-Band earth station in Kalama, WA were also sent to the following 28 GHz local television transmission licensee. This licensee is authorized to operate temporary fixed operations from 27.5 – 29.5 GHz on a nationwide basis.

Licensee	Authorized Geographic Area
Information Super Station, LLC	Continental US

No objections were received from the common carrier or local television transmission service incumbents.

¹ The proposed earth station will operate in the 27.5 – 29.1 GHz & 29.5 – 30.0 GHz portion of the Ka-Band.

3. 28 GHz UMFUS Coordination

There were four 28 GHz UMFUS licensees identified within the coordination distance of the proposed earth station. The proposed earth station will operate on frequencies that overlap Channel L1 & L2 of the UMFUS service. The total frequency allocation for Channels L1 & L2 of the UMFUS spectrum appears below.

Channel: **L1** 27.500 - 27.925 GHz
 L2 27.925 - 28.350 GHz

Licensee	Authorized Geographic Area
Cellco Partnership	County-Based
Wilcom LLC	County-Based
T-Mobile License LLC	County-Based
MCDANIEL CELLULAR TELEPHONE COMPANY	County-Based

No objections were received from the UMFUS incumbents.



4. Earth Station Coordination Data

This section presents the data pertinent to the proposed Ka-Band earth station in Kalama, WA. This data was circulated to all incumbent licensees in the shared 28 GHz frequency ranges.

Administrative Information

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

Site Information

Site Information	KALAMA, WA
Venue Name	
Latitude (NAD 83)	46° 2' 20.3" N
Longitude (NAD 83)	122° 48' 29.6" W
Climate Zone	A
Rain Zone	3
Ground Elevation (AMSL)	151.07 m / 495.6 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		Transmit - FCC32	
Manufacturer		SpaceX		SpaceX	
Model		1.47 meter		1.47 meter	
Gain / Diameter		46.9 dBi / 1.5 m		49.5 dBi / 1.5 m	
3-dB / 15-dB Beamwidth		0.77° / 1.70°		0.49° / 1.17°	
Max Available RF Power	(dBW/4 kHz)			-39.8	
	(dBW/MHz)			-15.8	
Maximum EIRP	(dBW/4 kHz)			9.7	
	(dBW/MHz)			33.7	
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%				

Frequency Information

	Receive 18.0 GHz		Transmit 28.0 GHz	
Emission / Frequency Range (MHz)	62M5D7W - 480MD7W / 17800.0 - 18600.0 62M5D7W - 480MD7W / 18800.0 - 19300.0		62M5D7W - 480MD7W / 27500.0 - 29100.0 62M5D7W - 480MD7W / 29500.0 - 30000.0	
Max Great Circle Coordination Distance	262.0 km / 162.8 mi		125.0 km / 77.7 mi	
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi		100.0 km / 62.1 mi	



SPACE EXPLORATION HOLDINGS
Ka-Band Earth Station – Kalama, WA
Frequency Coordination Report
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Coordination Values	KALAMA, WA		
Licensee Name	Space Exploration Holdings		
Latitude (NAD 83)	46° 2' 20.3" N		
Longitude (NAD 83)	122° 48' 29.6" W		
Ground Elevation (AMSL)	151.07 m / 495.6 ft		
Antenna Centerline (AGL)	0.91 m / 3.0 ft		
Antenna Model	SpaceX 1.47 meter		
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 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			-39.8 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	68.54	-3.00	262.00	-3.00	125.00
5	0.00	64.34	-3.00	262.00	-3.00	125.00
10	0.00	60.19	-3.00	262.00	-3.00	125.00
15	0.00	56.13	-3.00	262.00	-3.00	125.00
20	0.00	52.17	-3.00	262.00	-3.00	125.00
25	0.00	48.34	-3.00	262.00	-3.00	125.00
30	0.00	44.69	-3.00	262.00	-3.00	125.00
35	0.00	41.25	-3.00	262.00	-3.00	125.00
40	0.00	38.10	-3.00	262.00	-3.00	125.00
45	0.00	35.30	-3.00	262.00	-3.00	125.00
50	0.00	32.96	-3.00	262.00	-3.00	125.00
55	0.00	31.18	-3.00	262.00	-3.00	125.00
60	0.00	30.05	-3.00	262.00	-3.00	125.00
65	0.00	29.65	-3.00	262.00	-3.00	125.00
70	0.00	30.01	-3.00	262.00	-3.00	125.00
75	0.00	31.11	-3.00	262.00	-3.00	125.00
80	0.00	32.87	-3.00	262.00	-3.00	125.00
85	0.00	35.19	-3.00	262.00	-3.00	125.00
90	0.00	37.97	-3.00	262.00	-3.00	125.00
95	0.00	41.11	-3.00	262.00	-3.00	125.00
100	0.00	44.53	-3.00	262.00	-3.00	125.00
105	0.00	48.18	-3.00	262.00	-3.00	125.00
110	0.00	52.00	-3.00	262.00	-3.00	125.00
115	0.00	55.95	-3.00	262.00	-3.00	125.00
120	0.00	60.01	-3.00	262.00	-3.00	125.00
125	0.00	64.15	-3.00	262.00	-3.00	125.00
130	0.00	68.36	-3.00	262.00	-3.00	125.00
135	0.00	72.61	-3.00	262.00	-3.00	125.00
140	0.00	76.91	-3.00	262.00	-3.00	125.00
145	0.00	81.22	-3.00	262.00	-3.00	125.00
150	0.00	85.56	-3.00	262.00	-3.00	125.00
155	0.00	89.90	-3.00	262.00	-3.00	125.00
160	0.00	94.25	-3.00	262.00	-3.00	125.00
165	0.00	98.58	-3.00	262.00	-3.00	125.00
170	0.00	102.90	-3.00	262.00	-3.00	125.00
175	0.00	107.20	-3.00	262.00	-3.00	125.00
180	0.00	111.46	-3.00	262.00	-3.00	125.00
185	0.00	115.66	-3.00	262.00	-3.00	125.00



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Coordination Values	KALAMA, WA		
Licensee Name	Space Exploration Holdings		
Latitude (NAD 83)	46° 2' 20.3" N		
Longitude (NAD 83)	122° 48' 29.6" W		
Ground Elevation (AMSL)	151.07 m / 495.6 ft		
Antenna Centerline (AGL)	0.91 m / 3.0 ft		
Antenna Model	SpaceX 1.47 meter		
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 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	-39.8 (dBW/4 kHz)		

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	119.81	-3.00	262.00	-3.00	125.00
195	0.00	123.87	-3.00	262.00	-3.00	125.00
200	0.00	127.83	-3.00	262.00	-3.00	125.00
205	0.00	131.66	-3.00	262.00	-3.00	125.00
210	0.00	135.31	-3.00	262.00	-3.00	125.00
215	0.00	138.75	-3.00	262.00	-3.00	125.00
220	0.00	141.90	-3.00	262.00	-3.00	125.00
225	0.00	144.70	-3.00	262.00	-3.00	125.00
230	0.00	147.04	-3.00	262.00	-3.00	125.00
235	0.00	148.82	-3.00	262.00	-3.00	125.00
240	0.00	149.95	-3.00	262.00	-3.00	125.00
245	0.00	150.35	-3.00	262.00	-3.00	125.00
250	0.00	149.99	-3.00	262.00	-3.00	125.00
255	0.00	148.89	-3.00	262.00	-3.00	125.00
260	0.00	147.13	-3.00	262.00	-3.00	125.00
265	0.00	144.81	-3.00	262.00	-3.00	125.00
270	0.00	142.03	-3.00	262.00	-3.00	125.00
275	0.00	138.89	-3.00	262.00	-3.00	125.00
280	0.00	135.47	-3.00	262.00	-3.00	125.00
285	0.00	131.82	-3.00	262.00	-3.00	125.00
290	0.00	128.00	-3.00	262.00	-3.00	125.00
295	0.00	124.05	-3.00	262.00	-3.00	125.00
300	0.00	119.99	-3.00	262.00	-3.00	125.00
305	0.00	115.85	-3.00	262.00	-3.00	125.00
310	0.00	111.64	-3.00	262.00	-3.00	125.00
315	0.00	107.39	-3.00	262.00	-3.00	125.00
320	0.00	103.09	-3.00	262.00	-3.00	125.00
325	0.00	98.78	-3.00	262.00	-3.00	125.00
330	0.00	94.44	-3.00	262.00	-3.00	125.00
335	0.00	90.10	-3.00	262.00	-3.00	125.00
340	0.00	85.75	-3.00	262.00	-3.00	125.00
345	0.00	81.42	-3.00	262.00	-3.00	125.00
350	0.00	77.10	-3.00	262.00	-3.00	125.00
355	0.00	72.80	-3.00	262.00	-3.00	125.00



5. Contact Information

For questions or information regarding the 28 GHz Frequency Coordination Report, please contact:

Contact person:	Dennis Jimeno
Title:	Engineer III, Telecommunications
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5858
Fax:	703-726-5599
Email:	DJimeno@Comsearch.com
Web site:	www.comsearch.com

FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Space Exploration Holdings
KALAMA, WA
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
February 4, 2020

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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 12/09/2019.

Company

AT&T Mobility Spectrum LLC - Washington
AT&T Mobility Wireless Ops Hldgs - WA
AT&T Mobility Wireless Ops Hldgs Inc -OR
Accel Net, Inc.
Air Speed Internet, LLC
All Classical Public Media, Inc
Alyrica Networks, Inc.
Astound Broadband, LLC
Bain, Robert B
Bates Technical College
Battle Ground Public Schools
Bellevue Community College (KBCS)
Bend, City of
Boeing Company
Business Only Broadband, LLC
Cellco Partnership - Washington
Cencom - Kitsap 911
Christian Broadcasting of Yakima
City of Bend Public Works
City of Portland
City of Prineville
City of Sandy, OR
Clearwire Spectrum Holdings II, LLC
Clearwire Spectrum Holdings III, LLC
Clearwire Spectrum Holdings LLC
Community Transit Snohomish County PTBA
Computer 5, Inc.
Confluence Health
Cowlitz County Fire District #5
Cyberdyne Networks, Inc.
Day Management Corporation
Deschutes County 911
Deschutes, County of
Eastside Public Safety Com Agency
Eugene, City of
Everett Clinic
Everett MSO, Inc.
Falcon Cable Systems Co. II, L.P.
Fixed Wireless Holdings, LLC
Freewire Broadband LLC

Frontier Telenet
Global Data Link, Inc
Gorge Networks
Infinity Internet
KIRO-TV, Inc
KMTR Television, LLC
Kittcom
Lane Education Service District
Lane Transit District
Marion County Public Works
McMinnville Access Company
Meritel Group, Inc.
Mosier WiNet, LLC
NEXSTAR BROADCASTING, INC.
NW Natural Gas Company
New Cingular Wireless PCS LLC -OR Region
New Cingular Wireless PCS LLC-Washington
Newberg, City of
Nextel West Corporation
Noel Communications, Inc.
North Central ESD
Olympia Cellular Limited Partnership
Olympic Wireless, LLC
Oregon Health and Science University
Oregon Public Broadcasting (KOPB)
Oregon RSA #2, Inc.
Oregon State
Oregon, State of (ODOT)
Pacific Bell Tel Com dba AT&T California
Pick Two LLC
PocketiNet Communications Inc.
Port of Tacoma
Portland General Electric
Puget Sound Energy, Inc
Qwest Corporation
Richesin, Joshua L
Salem, City of
Sander Operating Co. III LLC
Sawtooth Technologies, LLC
Seattle FCC License Sub, LLC
Seattle SMSA Limited Partnership
Seattle's Best Internet, LLC
Seattle, City of
Seattle, City of (King)
Silke Communications, Inc.
Simplified Technologies, LLC
Sinclair Portland Licensee, LLC
Sinclair Seattle Licensee, LLC
Skyline Tower LLC
Skys The Limit Broadband
Snohomish County Emergency Radio System
Sprint Spectrum L.P.
Sprint Spectrum LP Seattle
Sprint Spectrum Portland MTA
Sprintcom, Inc
St. Anthony Hospital

Startouch, Inc.
Stephouse Holdings Company, LLC
T-Mobile Lic LLC - Voicestream PCS BTA I
T-Mobile License LLC
Towerstream Corp.
Union Pacific Railroad Company
United Telephone Co. of the Northwest
University Of Washington
UnwiredWest, LLC
Verizon Wireless (VAW) LLC - (WA)
Verizon Wireless (VAW) LLC-Portland, OR
Washington State of Dept of Transportat
WaveDivision VII, LLC
Webformix Company
Whiz to Coho, Inc.
Wiline Spectrum Holdings LLC
Wirelessco L.P.
Woodburn, City of
Yakama Indian Nation
Yakima City Washington
Yamhill County Sheriff's Office
Yellowknife Wireless Company, LLC

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: 01/17/2020
Job Number: 191209COMSGE04

Administrative Information

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

Site Information

KALAMA, WA

Venue Name
Latitude (NAD 83) 46° 2' 20.3" N
Longitude (NAD 83) 122° 48' 29.6" W
Climate Zone A
Rain Zone 3
Ground Elevation (AMSL) 151.07 m / 495.6 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

Transmit - FCC32

Manufacturer	SpaceX	SpaceX			
Model	1.47 meter	1.47 meter			
Gain / Diameter	46.9 dBi / 1.5 m	49.5 dBi / 1.5 m			
3-dB / 15-dB Beamwidth	0.77° / 1.70°	0.49° / 1.17°			
Max Available RF Power (dBW/4 kHz)		-39.8			
(dBW/MHz)		-15.8			
Maximum EIRP (dBW/4 kHz)		9.7			
(dBW/MHz)		33.7			
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%

Frequency Information

Receive 18.0 GHz

Transmit 28.0 GHz

Emission / Frequency Range (MHz)	62M5D7W - 480MD7W / 17800.0 - 18600.0	62M5D7W - 480MD7W / 27500.0 - 29100.0
	62M5D7W - 480MD7W / 18800.0 - 19300.0	62M5D7W - 480MD7W / 29500.0 - 30000.0

Max Great Circle Coordination Distance	262.0 km / 162.8 mi	125.0 km / 77.7 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

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

Coordination Values

KALAMA, WA

Licensee Name	Space Exploration Holdings		
Latitude (NAD 83)	46° 2' 20.3" N		
Longitude (NAD 83)	122° 48' 29.6" W		
Ground Elevation (AMSL)	151.07 m / 495.6 ft		
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Antenna Model	SpaceX 1.47 meter		
Antenna Mode	Receive 18.0 GHz		Transmit 28.0 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		-39.8 (dBW/4 kHz)	

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	68.54	-3.00	262.00	-3.00	125.00
5	0.00	64.34	-3.00	262.00	-3.00	125.00
10	0.00	60.19	-3.00	262.00	-3.00	125.00
15	0.00	56.13	-3.00	262.00	-3.00	125.00
20	0.00	52.17	-3.00	262.00	-3.00	125.00
25	0.00	48.34	-3.00	262.00	-3.00	125.00
30	0.00	44.69	-3.00	262.00	-3.00	125.00
35	0.00	41.25	-3.00	262.00	-3.00	125.00
40	0.00	38.10	-3.00	262.00	-3.00	125.00
45	0.00	35.30	-3.00	262.00	-3.00	125.00
50	0.00	32.96	-3.00	262.00	-3.00	125.00
55	0.00	31.18	-3.00	262.00	-3.00	125.00
60	0.00	30.05	-3.00	262.00	-3.00	125.00
65	0.00	29.65	-3.00	262.00	-3.00	125.00
70	0.00	30.01	-3.00	262.00	-3.00	125.00
75	0.00	31.11	-3.00	262.00	-3.00	125.00
80	0.00	32.87	-3.00	262.00	-3.00	125.00
85	0.00	35.19	-3.00	262.00	-3.00	125.00
90	0.00	37.97	-3.00	262.00	-3.00	125.00
95	0.00	41.11	-3.00	262.00	-3.00	125.00
100	0.00	44.53	-3.00	262.00	-3.00	125.00
105	0.00	48.18	-3.00	262.00	-3.00	125.00
110	0.00	52.00	-3.00	262.00	-3.00	125.00
115	0.00	55.95	-3.00	262.00	-3.00	125.00
120	0.00	60.01	-3.00	262.00	-3.00	125.00
125	0.00	64.15	-3.00	262.00	-3.00	125.00
130	0.00	68.36	-3.00	262.00	-3.00	125.00
135	0.00	72.61	-3.00	262.00	-3.00	125.00
140	0.00	76.91	-3.00	262.00	-3.00	125.00
145	0.00	81.22	-3.00	262.00	-3.00	125.00
150	0.00	85.56	-3.00	262.00	-3.00	125.00
155	0.00	89.90	-3.00	262.00	-3.00	125.00
160	0.00	94.25	-3.00	262.00	-3.00	125.00
165	0.00	98.58	-3.00	262.00	-3.00	125.00
170	0.00	102.90	-3.00	262.00	-3.00	125.00
175	0.00	107.20	-3.00	262.00	-3.00	125.00
180	0.00	111.46	-3.00	262.00	-3.00	125.00
185	0.00	115.66	-3.00	262.00	-3.00	125.00

COMSEARCH

Earth Station Data Sheet

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

Coordination Values

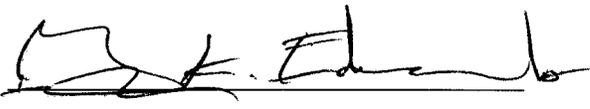
KALAMA, WA

Licensee Name Space Exploration Holdings
Latitude (NAD 83) 46° 2' 20.3" N
Longitude (NAD 83) 122° 48' 29.6" W
Ground Elevation (AMSL) 151.07 m / 495.6 ft
Antenna Centerline (AGL) 0.91 m / 3.0 ft
Antenna Model SpaceX 1.47 meter
Antenna Mode Receive 18.0 GHz Transmit 28.0 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 -39.8 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 18.0 GHz		Transmit 28.0 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	119.81	-3.00	262.00	-3.00	125.00
195	0.00	123.87	-3.00	262.00	-3.00	125.00
200	0.00	127.83	-3.00	262.00	-3.00	125.00
205	0.00	131.66	-3.00	262.00	-3.00	125.00
210	0.00	135.31	-3.00	262.00	-3.00	125.00
215	0.00	138.75	-3.00	262.00	-3.00	125.00
220	0.00	141.90	-3.00	262.00	-3.00	125.00
225	0.00	144.70	-3.00	262.00	-3.00	125.00
230	0.00	147.04	-3.00	262.00	-3.00	125.00
235	0.00	148.82	-3.00	262.00	-3.00	125.00
240	0.00	149.95	-3.00	262.00	-3.00	125.00
245	0.00	150.35	-3.00	262.00	-3.00	125.00
250	0.00	149.99	-3.00	262.00	-3.00	125.00
255	0.00	148.89	-3.00	262.00	-3.00	125.00
260	0.00	147.13	-3.00	262.00	-3.00	125.00
265	0.00	144.81	-3.00	262.00	-3.00	125.00
270	0.00	142.03	-3.00	262.00	-3.00	125.00
275	0.00	138.89	-3.00	262.00	-3.00	125.00
280	0.00	135.47	-3.00	262.00	-3.00	125.00
285	0.00	131.82	-3.00	262.00	-3.00	125.00
290	0.00	128.00	-3.00	262.00	-3.00	125.00
295	0.00	124.05	-3.00	262.00	-3.00	125.00
300	0.00	119.99	-3.00	262.00	-3.00	125.00
305	0.00	115.85	-3.00	262.00	-3.00	125.00
310	0.00	111.64	-3.00	262.00	-3.00	125.00
315	0.00	107.39	-3.00	262.00	-3.00	125.00
320	0.00	103.09	-3.00	262.00	-3.00	125.00
325	0.00	98.78	-3.00	262.00	-3.00	125.00
330	0.00	94.44	-3.00	262.00	-3.00	125.00
335	0.00	90.10	-3.00	262.00	-3.00	125.00
340	0.00	85.75	-3.00	262.00	-3.00	125.00
345	0.00	81.42	-3.00	262.00	-3.00	125.00
350	0.00	77.10	-3.00	262.00	-3.00	125.00
355	0.00	72.80	-3.00	262.00	-3.00	125.00

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: February 4, 2020