FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for
Discovery Communications, Inc.
STERLING, VA
Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, VA 20147
March 16, 2012

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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.

The following companies reported potential great circle interference conflicts that did not meet the objectives on a line-of-sight basis. When over-the-horizon losses are considered on the interfering paths, sufficient blockage exists to negate harmful interference from occurring with the proposed transmit-receive earth station.

Company

B20 LLC
Capital Communications of America
Cellco Partnership-Newark-Dallas Verizon
Comprehensive Wireless LLC
County of Frederick
ECW Wireless, LLC
MCI Communications Services Inc.
New Cingular Wireless PCS, LLC - PA
Thought Transmissions, LLC
Virginia Electric & Power Company

No other carriers reported potential interference cases.

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 01/31/2012.

Company
AT&T COMMUNICATIONS OF MARYLAND INC
AT&T COMMUNICATIONS OF VIRGINIA INC
AT&T CORP
Alltel Communications LLC-Southern VA
Alltel Communications of Petersburg Inc
Appalachian Broadcasting
Atlantic Broadband (Delmar), LLC
Atlantic Broadband (Penn), LLC
B20 LLC
BAY BROADBAND COMMUNICATIONS LLC
Baltimore County of Maryland
Baltimore Gas and Electric Company
Blue Ridge Carriers
COLLEGE OF SOUTHERN MARYLAND
Capital Communications of America
Cellco Partnership - Southern Virginia
Cellco Partnership- PA Region
Cellco Partnership-Newark-Dallas Verizon
Cellco Partnership-WA/Baltimore
Charles, County of
Comprehensive Wireless LLC
Conterra Ultra Broadband, LLC
County of Frederick
County of Stafford
ECW Wireless, LLC
Eastern MLG LLC
Enoch Pratt Free Library
FELHC, Inc.
Frederick County
Fundamental Broadcasting LLC
Garden State Transmissions
Hanover County Emergency Communications
Hardy Cellular Telephone Company
Harrisonburg-Rockingham ECC
Last Mile Inc.
Loudoun, County of
MCI Communications Services Inc.
METROPOLITAN AREA NETWORKS, INC.
MVC Research. LLC
Maryland Public Broadcasting Commission

Maryland State Highway Administration
Maryland, State of - Dept.of Info & Tech
National Radio Astronomy Observatory
New Cingular Wireless PCS LLC - DC
New Cingular Wireless PCS LLC - VA
New Cingular Wireless PCS, LLC - PA
Norfolk Southern Railway
Northern Virginia Electric Cooperative
PENNSYLVANIA TURNPIKE COMMISSION
Prince George's County
Prince William, County of
RAPPAHANNOCK ELECTRIC COOPERATIVE
SCTF NET
SHENANDOAH VALLEY ELECTRIC COOPERATIVE
Southern Maryland Electric Cooperative I
St. Mary's County of
State of Maryland, MIEMSS
State of WV DHHR/BPH STECS
Texas Eastern Communications, Inc.
Thought Transmissions, LLC
USCOC of Cumberland, Inc.
Verizon Wireless VAW LLC-Southern VA
Virginia Broadband, LLC
Virginia Cellular LLC
Virginia Department of State Police
Virginia Electric & Power Company
Virginia PCS Alliance, L.C.
WASHINGTON SUBURBAN SANITARY COMMISSION
Washington D.C. SMSA L.P.
Washington Gas Light Company
World Class Wireless LLC
iSignal

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:	03/15/2012
Job Number:	120131COMSGE01

Administrative Information

Status	ENGINEER PROPOSAL
Call Sign	
Licensee Code	DISCOM
Licensee Name	Discovery Communications, Inc.

Site Information — STERLING, VA

Venue Name	
Latitude (NAD 83)	38° 59' 16.1" N
Longitude (NAD 83)	77° 25' 31.1" W
Climate Zone	A
Rain Zone	2
Ground Elevation (AMSL)	92.05 m / 302.0 ft

Link Information

Satellite Type	Geostationary
Mode	TR - Transmit-Receive
Modulation	Digital
Satellite Arc	43° W to 143° West Longitude
Azimuth Range	132.6° to 254.1°
Corresponding Elevation Angles	32.6° / 10.2°
Antenna Centerline (AGL)	5.49 m / 18.0 ft

Antenna Information		Receive - FCC32		Transmit - FCC32	
Manufacturer		ViaSat		ViaSat	
Model		8009		8009	
Gain / Diameter		50.3 dBi / 9.0 m		53.8 dBi / 9.0 m	
3-dB / 15-dB Beamwidth		0.58° / 1.20°		0.38° / 0.80°	
Max Available RF Power	(dBW/4 kHz)			-15.0	
	(dBW/MHz)			9.0	
Maximum EIRP	(dBW/4 kHz)			38.8	
	(dBW/MHz)			62.8	
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
	Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%

Frequency Information	Receive 4.0 GHz	Transmit 6.1 GHz
Emission / Frequency Range (MHz)	30M0G7D / 3700.0 - 4200.0	30M0G7D / 5925.0 - 6425.0
Max Great Circle Coordination Distance	451.9 km / 280.7 mi	196.4 km / 122.0 mi
Precipitation Scatter Contour Radius	539.1 km / 335.0 mi	100.0 km / 62.1 mi

COMSEARCH

Earth Station Data Sheet

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Coordination Values	**STERLING, VA**			
Licensee Name	Discovery Communications, Inc.			
Latitude (NAD 83)	38° 59' 16.1" N			
Longitude (NAD 83)	77° 25' 31.1" W			
Ground Elevation (AMSL)	92.05 m / 302.0 ft			
Antenna Centerline (AGL)	5.49 m / 18.0 ft			
Antenna Model	ViaSat 9 meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-15.0 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.23	105.70	-10.00	281.95	-10.00	127.99
5	0.21	110.62	-10.00	283.41	-10.00	128.95
10	0.00	115.51	-10.00	285.28	-10.00	130.16
15	0.00	112.95	-10.00	285.28	-10.00	130.16
20	0.21	108.91	-10.00	283.90	-10.00	129.27
25	0.47	104.81	-10.00	253.07	-10.00	108.41
30	0.52	100.62	-10.00	248.64	-10.00	105.35
35	0.42	96.39	-10.00	258.68	-10.00	112.33
40	0.41	92.16	-10.00	259.45	-10.00	112.87
45	0.36	87.93	-10.00	265.71	-10.00	117.16
50	0.34	83.71	-10.00	267.77	-10.00	118.56
55	0.48	79.48	-10.00	251.83	-10.00	107.53
60	0.58	75.27	-10.00	244.59	-10.00	102.43
65	0.64	71.09	-10.00	241.02	-10.00	100.00
70	0.71	66.95	-10.00	236.65	-10.00	100.00
75	0.73	62.88	-10.00	235.62	-10.00	100.00
80	0.75	58.89	-10.00	234.46	-10.00	100.00
85	0.74	55.01	-10.00	234.85	-10.00	100.00
90	0.76	51.24	-10.00	233.82	-10.00	100.00
95	0.78	47.63	-9.95	232.76	-9.95	100.00
100	0.73	44.26	-9.15	240.30	-9.15	100.00
105	0.76	41.10	-8.35	243.08	-8.35	100.00
110	0.79	38.26	-7.57	245.66	-7.57	100.00
115	0.86	35.78	-6.84	245.53	-6.84	100.00
120	0.84	33.86	-6.24	250.35	-6.24	100.38
125	0.71	32.64	-5.84	261.44	-5.84	107.51
130	0.66	31.99	-5.62	266.02	-5.62	110.30
135	0.69	31.95	-5.61	263.99	-5.61	108.88
140	0.56	32.76	-5.88	270.90	-5.88	114.08
145	0.53	34.12	-6.32	270.37	-6.32	114.47
150	0.53	36.02	-6.91	266.60	-6.91	112.89
155	0.53	38.33	-7.59	262.34	-7.59	111.07
160	0.58	40.35	-8.15	255.33	-8.15	107.09
165	0.50	42.11	-8.61	258.48	-8.61	110.04
170	0.50	43.34	-8.92	255.91	-8.92	108.74
175	0.52	44.08	-9.11	253.74	-9.11	107.51
180	0.00	44.86	-9.30	289.79	-9.30	132.05
185	0.00	44.60	-9.23	290.21	-9.23	132.22

COMSEARCH

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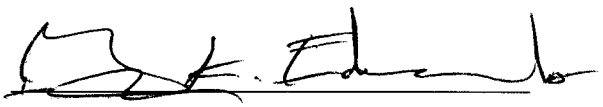
Coordination Values	**STERLING, VA**			
Licensee Name	Discovery Communications, Inc.			
Latitude (NAD 83)	38° 59' 16.1" N			
Longitude (NAD 83)	77° 25' 31.1" W			
Ground Elevation (AMSL)	92.05 m / 302.0 ft			
Antenna Centerline (AGL)	5.49 m / 18.0 ft			
Antenna Model	ViaSat 9 meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-15.0 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	43.82	-9.04	291.44	-9.04	132.73
195	0.00	42.56	-8.73	293.51	-8.73	133.58
200	0.00	40.86	-8.28	296.44	-8.28	133.53
205	0.00	38.77	-7.71	300.25	-7.71	135.10
210	0.00	36.34	-7.01	305.01	-7.01	137.09
215	0.00	33.62	-6.17	310.84	-6.17	139.56
220	0.00	30.67	-5.17	318.49	-5.17	142.60
225	0.00	27.51	-3.99	326.93	-3.99	146.33
230	0.00	24.19	-2.59	337.12	-2.59	150.97
235	0.00	20.74	-0.92	349.62	-0.92	156.84
240	0.00	17.17	1.13	365.34	1.13	164.48
245	0.00	13.60	3.66	385.42	3.66	175.96
250	0.00	10.96	6.01	404.09	6.01	185.02
255	0.00	10.23	6.75	451.87	6.75	196.42
260	0.00	11.78	5.22	397.50	5.22	181.98
265	0.00	14.91	2.66	377.38	2.66	172.06
270	0.00	18.85	0.12	357.49	0.12	160.63
275	0.00	23.19	-2.13	340.51	-2.13	152.54
280	0.00	27.75	-4.08	326.26	-4.08	146.03
285	0.00	32.42	-5.77	314.23	-5.77	140.75
290	0.00	37.18	-7.26	303.33	-7.26	136.39
295	0.00	41.98	-8.58	294.50	-8.58	133.99
300	0.00	46.82	-9.76	286.81	-9.76	130.81
305	0.00	51.68	-10.00	285.28	-10.00	130.16
310	0.00	56.56	-10.00	285.28	-10.00	130.16
315	0.00	61.45	-10.00	285.28	-10.00	130.16
320	0.00	66.35	-10.00	285.28	-10.00	130.16
325	0.00	71.26	-10.00	285.28	-10.00	130.16
330	0.00	76.17	-10.00	285.28	-10.00	130.16
335	0.00	81.09	-10.00	285.28	-10.00	130.16
340	0.00	86.01	-10.00	285.28	-10.00	130.16
345	0.00	90.93	-10.00	285.28	-10.00	130.16
350	0.00	95.85	-10.00	285.28	-10.00	130.16
355	0.00	100.77	-10.00	285.28	-10.00	130.16

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 16, 2012

Analysis of Non-Ionizing Radiation for a 9.0-Meter Earth Station System

This report analyzes the non-ionizing radiation levels for a 9.0-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^2)
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^2)
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	9.0	m
Antenna Surface Area	$A_{surface}$	$\pi D^2 / 4$	63.62	m^2
Subreflector Diameter	D_{sr}	Input	121.9	cm
Area of Subreflector	A_{sr}	$\pi D_{sr}{}^2/4$	11674.54	cm^2
Frequency	F	Input	6175	MHz
Wavelength	λ	300 / F	0.048583	m
Transmit Power	P	Input	501.20	W
Antenna Gain (dBi)	G_{es}	Input	53.8	dBi
Antenna Gain (factor)	G	$10^{Ges/10}$	239883.3	n/a
Pi	π	Constant	3.1415927	n/a
Antenna Efficiency	η	$G\lambda^2/(\pi^2D^2)$	0.71	n/a

1. Far Field Distance Calculation

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

Distance to the Far Field Region

$$R_{ff} = 0.60\ D^2 / \lambda \quad (1)$$
$$= 1000.4\ m$$

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

On-Axis Power Density in the Far Field

$$S_{ff} = G\ P / (4\ \pi\ R_{ff}^{\ 2}) \quad (2)$$
$$= 9.561\ W/m^2$$
$$= 0.956\ mW/cm^2$$

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:

Extent of the Near Field

$$R_{nf} = D^2 / (4\ \lambda) \quad (3)$$
$$= 416.8\ m$$

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

Near Field Power Density

$$S_{nf} = 16.0\ \eta\ P / (\pi\ D^2) \quad (4)$$
$$= 22.319\ W/m^2$$
$$= 2.232\ mW/cm^2$$

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:

Transition Region Power Density

$$S_t = S_{nf}\ R_{nf} / R_t \quad (5)$$
$$= 2.232\ mW/cm^2$$

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:

Power Density at the Subreflector

$$S_{sr} = 4000\ P / A_{sr} = 171.724\ mW/cm^2 \quad (6)$$

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:

Power Density at the Main Reflector Surface

$$S_{surface} = 4\ P / A_{surface} = 31.513\ W/m^2 = 3.151\ mW/cm^2 \quad (7)$$

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:

Power Density between Reflector and Ground

$$S_g = P / A_{surface} = 7.878\ W/m^2 = 0.788\ mW/cm^2 \quad (8)$$

7. Summary of Calculations

Table 4. Summary of Expected Radiation levels for Uncontrolled Environment

Region		Calculated Maximum Radiation Power Density Level (mW/cm^2)	Hazard Assessment
1. Far Field (R_{ff} = 1000.4 m)	S_{ff}	0.956	Satisfies FCC MPE
2. Near Field (R_{nf} = 416.8 m)	S_{nf}	2.232	Potential Hazard
3. Transition Region ($R_{nf} < R_t < R_{ff}$)	S_t	2.232	Potential Hazard
4. Between Main Reflector and Subreflector	S_{sr}	171.724	Potential Hazard
5. Main Reflector	$S_{surface}$	3.151	Potential Hazard
6. Between Main Reflector and Ground	S_g	0.788	Satisfies FCC MPE

Table 5. Summary of Expected Radiation levels for Controlled Environment

Region		Calculated Maximum Radiation Power Density Level (mW/cm^2)	Hazard Assessment
1. Far Field (R_{ff} = 1000.4 m)	S_{ff}	0.956	Satisfies FCC MPE
2. Near Field (R_{nf} = 416.8 m)	S_{nf}	2.232	Satisfies FCC MPE
3. Transition Region ($R_{nf} < R_t < R_{ff}$)	S_t	2.232	Satisfies FCC MPE
4. Between Main Reflector and Subreflector	S_{sr}	171.724	Potential Hazard
5. Main Reflector	$S_{surface}$	3.151	Satisfies FCC MPE
6. Between Main Reflector and Ground	S_g	0.788	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.

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. Operation of the proposed antenna will not go below 10.2 degrees in elevation.

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) 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.*