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## **Transmission Engineering Design Report**

Presented to

**Town of Cumberland, ME**

<b>Project Name</b>	<b>Survey Dates</b>	<b>Report Release Date</b>	<b>Report Number</b>	<b>Report Release Number</b>
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## 1. INTRODUCTION

### 1.1 SCOPE OF WORK

Information presented in this report represents data collected during path and site surveys conducted by Radyn in April 2022 for Communications Design Consulting Group. This survey was performed to provide site and path interconnect information for 3 microwave paths and 4 sites. Communications Design Consulting Group selected all sites and paths surveyed and presented in this report.

The data contained in this report reflect the path designs as known at the time of this survey, but may not reflect subsequent or final designs dictated by other factors such as environmental, construction, tower/zoning restrictions, FAA clearance, performance calculations, frequency coordination, anomalous fading conditions, etc.

Site information was collected at the following sites:

#	Site Name
1	Chebeague Island
2	Golf Course
3	Range Way
4	West Cumberland FD

And a path survey was conducted for the following paths:

#	Path Name	Line of Sight Status
1	Golf Course to Range Way	Clear
2	Range Way to Chebeague Island	Clear
3	West Cumberland FD to Range Way	Clear

#### Range Way

A new 180 ft tower will be built.

#### West Cumberland FD

A new tower will be built.

#### **Comments:**

##### Golf Course - Range Way

The path will have 60% F1 at  $K=1.33$  and 30% F1 at  $K=0.67 + 10$  ft tree growth clearance at the proposed antenna heights.

##### Range Way - Chebeague Island

The path will have 60% F1 at  $K=1.33$  and 30% F1 at  $K=0.67 + 10$  ft tree growth clearance at the proposed antenna heights.

##### West Cumberland FD - Range Way

The path will have 60% F1 at  $K=1.33$  and 30% F1 at  $K=0.67 + 10$  ft tree growth clearance at the proposed antenna heights.

## 1.2 METHOD OF SURVEY

A preliminary path profile is created using originally supplied site coordinates to determine initial critical points along the path. This preliminary profile uses terrain and feature data available with software processing to identify significant natural and man-made features along the path. Radyn uses 1/9 second, 1/3 second, or 1 second digital terrain data, using the highest resolution USGS data available for the area. Should the original site coordinates differ significantly from field data, the preliminary profile will be reworked to provide a more accurate path profile.

In the field, site coordinates and ground elevations are accurately determined by measurement using DGPS. Site features and details are noted and a plot of the site area is created. Heights of towers and appurtenances are measured using a computerized laser device. In addition, heights may also be visually confirmed by evaluating physical features, such as tower sections of known size. Elevation data are compared with map and terrain data and investigated when inconsistencies are significant.

The proposed paths are then traversed to locate initial critical points and to find other critical points. Terrain features of path areas that might affect propagation, both man-made and naturally occurring, are noted so that the maximum expected future height can be plotted on the path profiles. Ground elevations and coordinates are recorded using DGPS. Where direct measurement is not possible, DGPS equipment is used to measure offset coordinates and digital terrain data along with topographic maps are used to determine ground elevation. Object heights are determined by using a computerized laser device capable of determining heights by accurately measuring distance and inclination. When a range of objects along the path is identified, the start and end points are identified and the height is taken from the highest object in the range, for example, the highest tree in a range of trees.

## 1.3 CONSTRUCTION OF PATH PROFILES

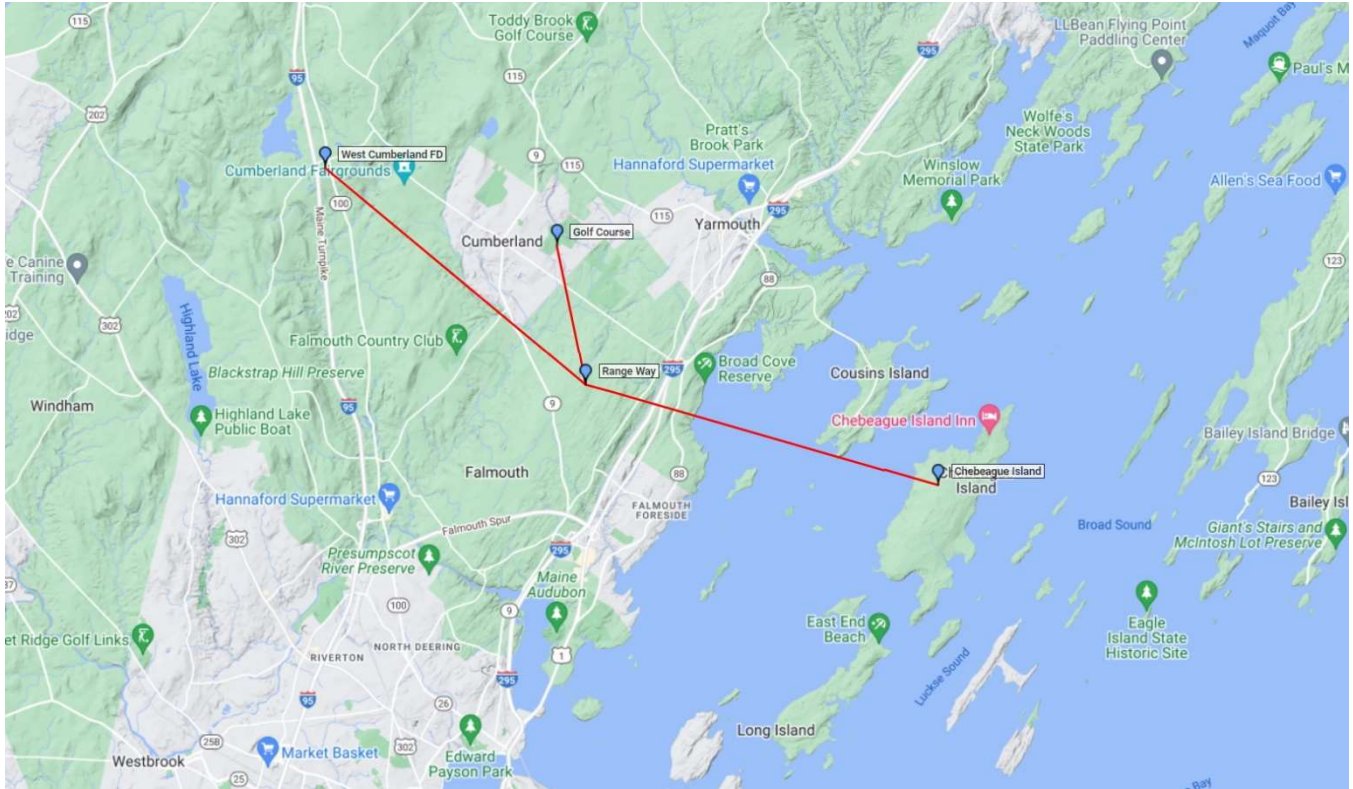
To provide a precise analysis of the clearance available over obstacles, path data was compiled on a Path Data Sheet. This was then transferred to a computer-generated profile using survey and digital terrain data to plot terrain features, vegetation, and man-made obstructions in the area of the sites as well as underlying and bordering the path line. Obstructions are listed on the path data sheets with coding to indicate the type of feature and whether it is On Path or Off Path.

The path profile was determined by plotting elevations using the best terrain data supplemented by field data. Critical point location and elevation data are as surveyed, supplemented by digital terrain data where direct survey methods were not possible. All locations are expressed in NAD-83 coordinates. Where applicable, an additional 10 feet is allowed for future vegetation growth. Features were determined to be On Path if they occur within the first Fresnel zone of the path. Potentially significant features outside the first Fresnel zone were labeled as Off Path and the distance and direction from the path was given. Software was used to create a path profile in a format that can be imported directly to most path design software.

The recommended antenna mounting height centerlines were chosen to provide a minimum path clearance of 1.0 of the first Fresnel Zone when  $K = 4/3$  and 0.3 of the first Fresnel Zone when  $K = 2/3$  for the main antennas and 0.6 of the first Fresnel Zone when  $K=4/3$  for diversity antennas except where other criteria were designated by Communications Design Consulting Group.

## 2. REPORT SUMMARY

### 2.1 SYSTEM MAP



### 2.2 SITE COORDINATES

Site Name	Latitude (NAD83)	Longitude (NAD83)	Elevation AMSL
Chebeague Island	43 44 25.74 N	070 07 09.81 W	138 ft
Golf Course	43 47 44.71 N	070 14 27.87 W	110 ft
Range Way	43 45 49.14 N	070 13 54.08 W	209 ft
West Cumberland FD	43 48 48.35 N	070 18 53.46 W	295 ft

### 2.3 ANTENNA STRUCTURE

	Existing or To Be Built?	Type	Structure Height To			
			Level 1	Level 2	Level 3	Tip
Chebeague Island	Existing	Self-support Tower	120 ft			
Golf Course	Existing	Monopole	100 ft			
Range Way	To Be Built	Self-support Tower	180 ft			
West Cumberland FD	To Be Built					

### 2.4 PROPOSED ANTENNA CENTERLINES AND CABLE LENGTHS

Site A			Site B		
Site Name	ACL AGL	Waveguide/Coaxial Type and Length	Waveguide/Coaxial Type and Length	ACL AGL	Site Name
Golf Course	M: 92 ft D:	M: 170 ft D:	M: 261 ft D:	M: 175 ft D:	Range Way
Range Way	M: 130 ft D:	M: 212 ft D:	M: 226 ft D:	M: 105 ft D:	Chebeague Island
West Cumberland FD	M: 110 ft D:	M: 190 ft D:	M: 212 ft D:	M: 130 ft D:	Range Way

M - Main Antenna D - Diversity Antenna

### 2.5 PROPOSED ANTENNA CONFIGURATION

Site A			Site B		
Site Name	Make and Model	Pol.	Pol.	Make and Model	Site Name
Golf Course	M: 2 FT Antenna D:	H	H	M: 2 FT Antenna D:	Range Way
Range Way	M: 2 FT Antenna D:	H	H	M: 2 FT Antenna D:	Chebeague Island
West Cumberland FD	M: 2 FT Antenna D:	H	H	M: 2 FT Antenna D:	Range Way

M - Main Antenna D - Diversity Antenna

### 2.6 PROPOSED EQUIPMENT CONFIGURATION

Site A				Site B			
Site Name	Make and Model	TxPw (dBm)	TxFreq (MHz)	TxFreq (MHz)	TxPw (dBm)	Make and Model	Site Name
Golf Course	MW Radio 11 GHz	28.5	11200	11200	28.5	MW Radio 11 GHz	Range Way
Range Way	MW Radio 11 GHz	28.5	11200	11200	28.5	MW Radio 11 GHz	Chebeague Island
West Cumberland FD	MW Radio 11 GHz	28.5	11200	11200	28.5	MW Radio 11 GHz	Range Way

## 2.7 TRUE / MAGNETIC AZIMUTHS

Site A			Site B		
Site Name	True	Magnetic	Magnetic	True	Site Name
Golf Course	168	183	3	348	Range Way
Range Way	106	121	301	286	Chebeague Island
West Cumberland FD	130	146	326	310	Range Way

## 2.8 LINE OF SIGHT STATUS

Site A	Line of Sight Status	Site B
Golf Course	Clear	Range Way
Range Way	Clear	Chebeague Island
West Cumberland FD	Clear	Range Way



### 3. SITE DATA

#### 3.1 CHEBEAGUE ISLAND

##### 3.1.1 LOCATION INFORMATION FOR CHEBEAGUE ISLAND

##### 3.1.1.1 Satellite View of Chebeague Island



##### 3.1.1.2 Site Coordinates and Ground Elevation for Chebeague Island

	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation
Preliminary	43 44 11.70 N	070 07 20.60 W	
Antenna Structure Registration (ASR)			
Call Sign / License			
DGPS	43 44 25.74 N	070 07 09.81 W	138 ft

Magnetic Declination = -14.92



**3.1.3 ANTENNA STRUCTURE INFORMATION FOR CHEBEAGUE ISLAND****3.1.3.1 Antenna Structure for Chebeague Island**

	Existing or To Be Built?	Type	Structure Leg Size at Bottom	Structure Height To			
				Level 1	Level 2	Level 3	Tip
Field Survey	Existing	Self-support Tower		120 ft			
Antenna Structure Registration (ASR)							

**3.1.3.2 Antenna Structure Pictures for Chebeague Island**

Picture #IMG\_0010 — Complete antenna structure at Chebeague Island, from top to bottom

### **3.1.4 SHELTER / EQUIPMENT ROOM INFORMATION FOR CHEBEAGUE ISLAND**

#### **3.1.4.1 Shelter / Equipment Room for Chebeague Island**

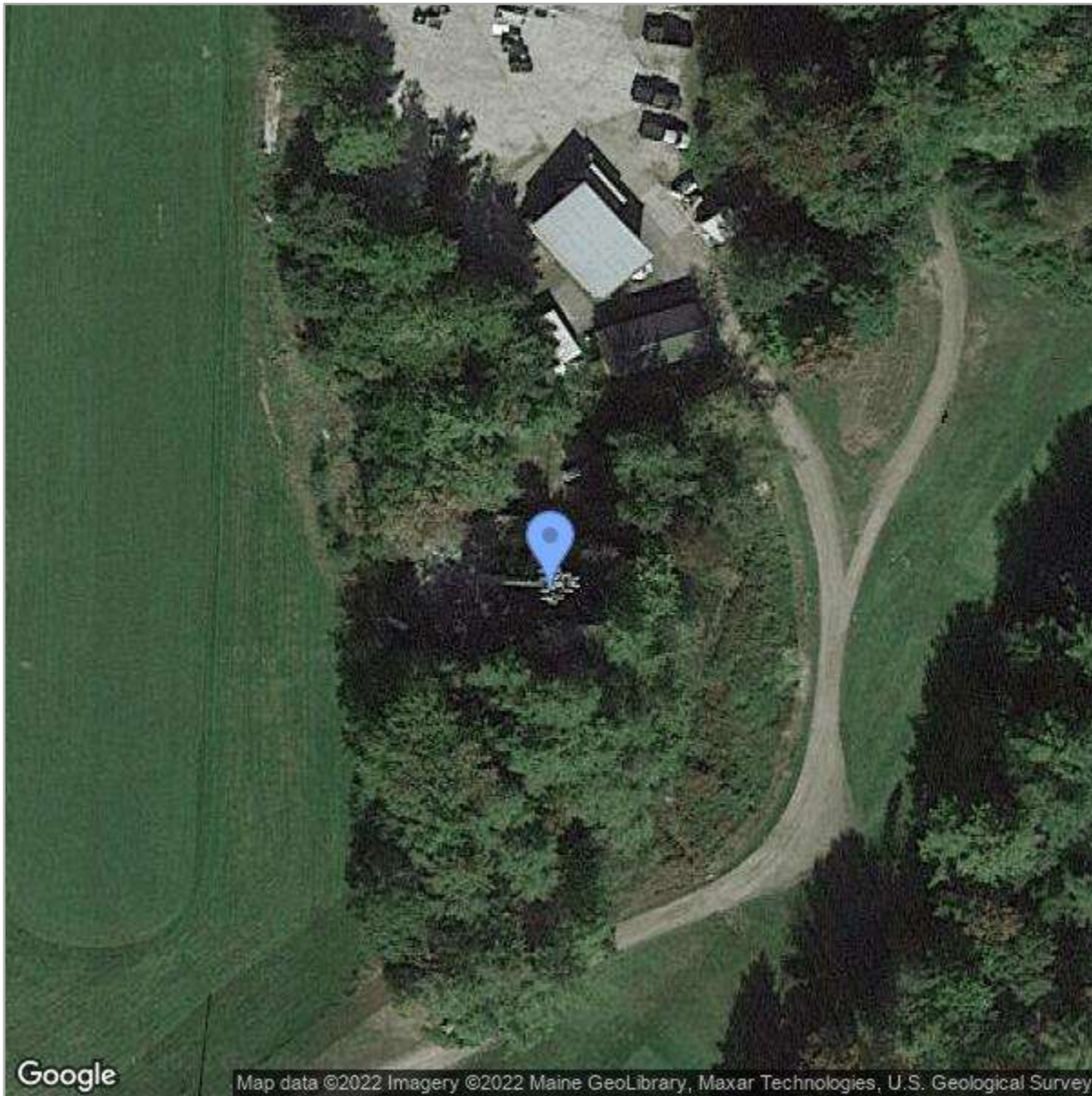


Picture #IMG\_0001 — Existing, Concrete Room, 6 ft L x 4 ft W x 10 ft H

### 3.2 GOLF COURSE

#### 3.2.1 LOCATION INFORMATION FOR GOLF COURSE

##### 3.2.1.1 Satellite View of Golf Course



##### 3.2.1.2 Site Coordinates and Ground Elevation for Golf Course

	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation
Preliminary	43 47 44.70 N	070 14 27.40 W	
Antenna Structure Registration (ASR)			
Call Sign / License			
DGPS	43 47 44.71 N	070 14 27.87 W	110 ft

Magnetic Declination = -14.88

### 3.2.3 ANTENNA STRUCTURE INFORMATION FOR GOLF COURSE

#### 3.2.3.1 Antenna Structure for Golf Course

	Existing or To Be Built?	Type	Structure Leg Size at Bottom	Structure Height To			
				Level 1	Level 2	Level 3	Tip
Field Survey	Existing	Monopole		100 ft			
Antenna Structure Registration (ASR)							

#### 3.2.3.2 Antenna Structure Pictures for Golf Course



Picture #IMG\_0115 — Complete antenna structure at Golf Course, from top to bottom

### **3.2.4 SHELTER / EQUIPMENT ROOM INFORMATION FOR GOLF COURSE**

#### **3.2.4.1 Shelter / Equipment Room for Golf Course**

To Be Built, Outdoor cabinet

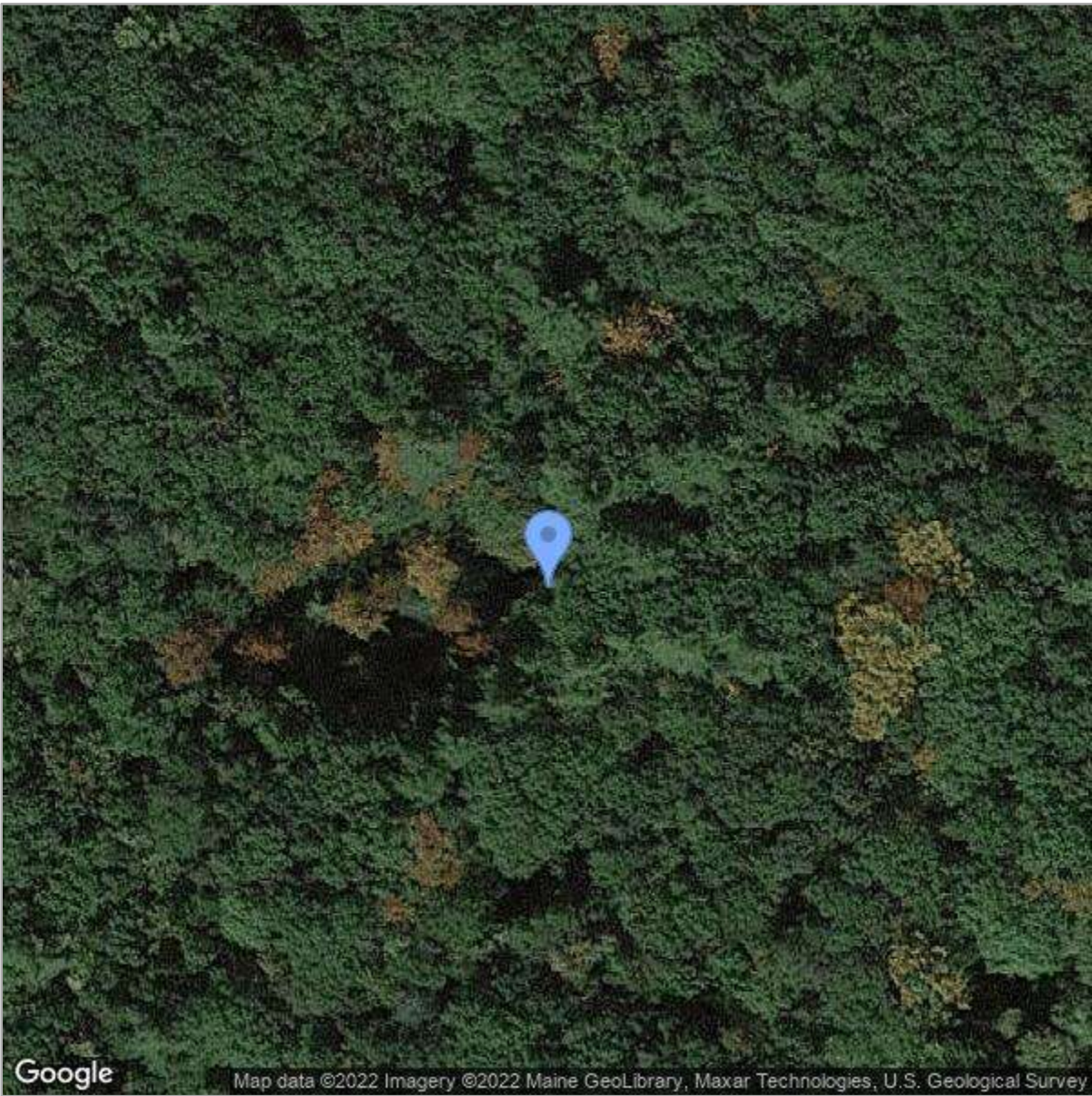
**Comment:** A new outdoor will be installed for the new equipment.



3.3 RANGE WAY

3.3.1 LOCATION INFORMATION FOR RANGE WAY

3.3.1.1 Satellite View of Range Way



3.3.1.2 Site Coordinates and Ground Elevation for Range Way

	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation
Preliminary	43 45 49.14 N	070 13 54.08 W	
Antenna Structure Registration (ASR)			
Call Sign / License			
DGPS	43 45 49.14 N	070 13 54.08 W	209 ft

Magnetic Declination = -14.88



3.3.3 ANTENNA STRUCTURE INFORMATION FOR RANGE WAY

3.3.3.1 Antenna Structure for Range Way

	Existing or To Be Built?	Type	Structure Leg Size at Bottom	Structure Height To			
				Level 1	Level 2	Level 3	Tip
Field Survey	To Be Built	Self-support Tower		180 ft			
Antenna Structure Registration (ASR)							

**3.3.4 SHELTER / EQUIPMENT ROOM INFORMATION FOR RANGE WAY**

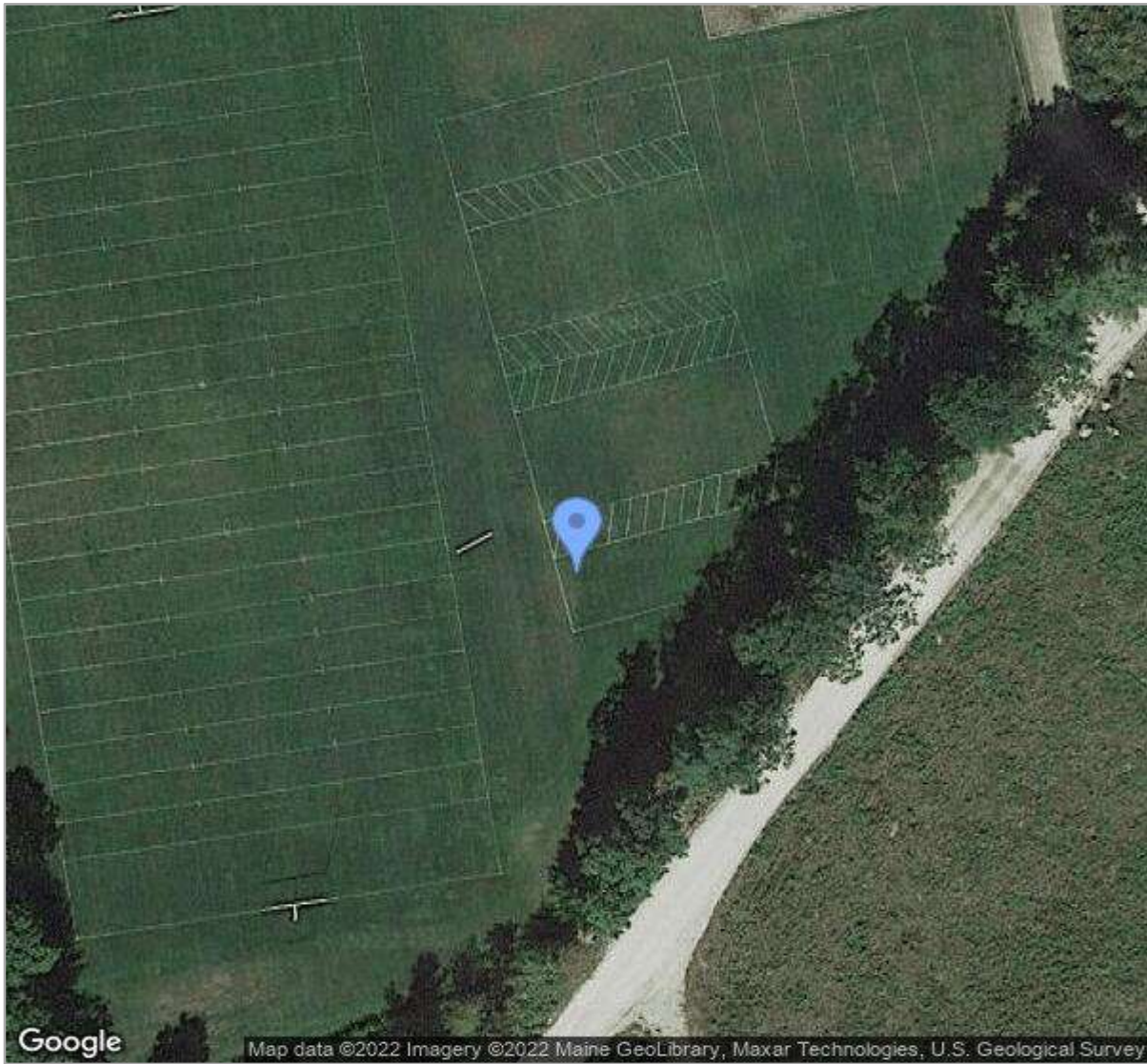
**3.3.4.1 Shelter / Equipment Room for Range Way**

To Be Built,

### 3.4 WEST CUMBERLAND FD

#### 3.4.1 LOCATION INFORMATION FOR WEST CUMBERLAND FD

##### 3.4.1.1 Satellite View of West Cumberland FD



##### 3.4.1.2 Site Coordinates and Ground Elevation for West Cumberland FD

	Latitude (NAD83)	Longitude (NAD83)	Ground Elevation
Preliminary	43 48 48.35 N	070 18 53.46 W	
Antenna Structure Registration (ASR)			
Call Sign / License			
DGPS	43 48 48.35 N	070 18 53.46 W	295 ft

Magnetic Declination = -15.75

3.4.3 ANTENNA STRUCTURE INFORMATION FOR WEST CUMBERLAND FD

3.4.3.1 Antenna Structure for West Cumberland FD

	Existing or To Be Built?	Type	Structure Leg Size at Bottom	Structure Height To			
				Level 1	Level 2	Level 3	Tip
Field Survey	To Be Built						
Antenna Structure Registration (ASR)							

**3.4.4 SHELTER / EQUIPMENT ROOM INFORMATION FOR WEST CUMBERLAND FD**

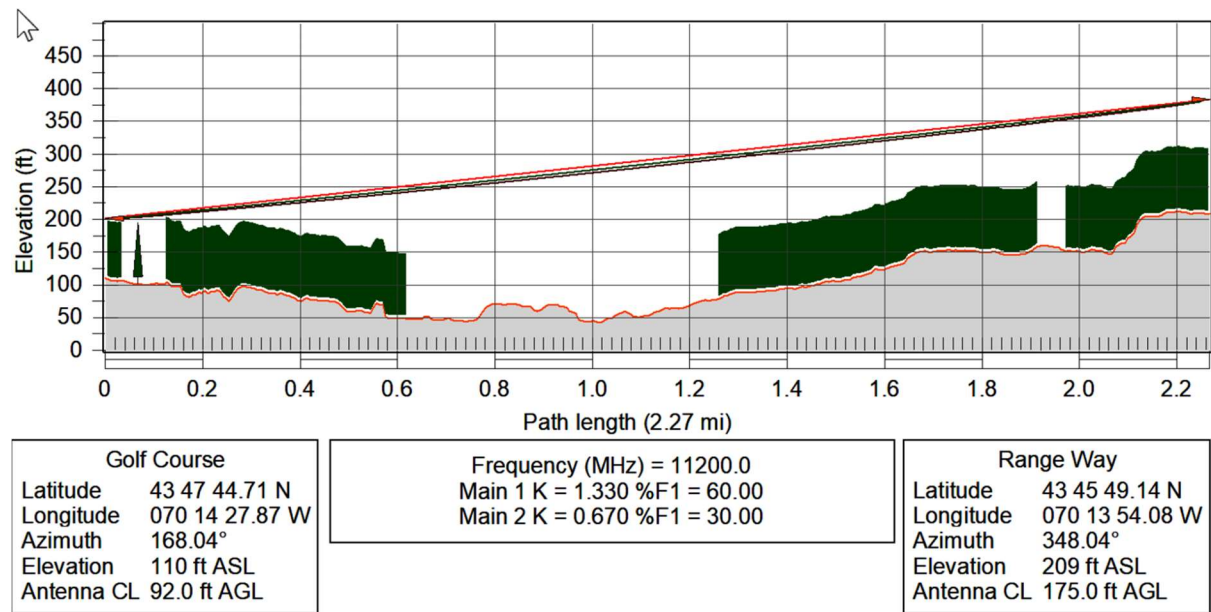
**3.4.4.1 Shelter / Equipment Room for West Cumberland FD**

To Be Built,

4. PATH DATA

4.1 GOLF COURSE TO RANGE WAY

4.1.1 PATH PROFILE FOR THE PATH FROM GOLF COURSE TO RANGE WAY



**Comments:** The 2.27-mile path starts at the higher elevation of the site, Golf Course. As the path propagates, the elevation decreases through the rough terrain. The elevation then steadily begins to increase through Cumberland, ME until eventually ending at the higher elevation of the site, Range Way. Along the path, the area is rural-residential and wooded with both deciduous and evergreen trees. There is a cluster of evergreen trees next to the site Golf Course that measures 80 ft. The area near the Golf Course site is under development and some trees have been turned down.



4.1.2 — GOLF COURSE TO RANGE WAY

	Golf Course	Range Way
Latitude	43 47 44.71 N	43 45 49.14 N
Longitude	070 14 27.87 W	070 13 54.08 W
True azimuth (°)	168.04	348.04
Vertical angle (°)	0.86	-0.88
Elevation (ft)	109.61	208.70
Tower height (ft)	100.00	180.00
Tower type	monopole	self supporting
Antenna model	2 FT Antenna (TR)	2 FT Antenna (TR)
Antenna gain (dBi)	34.80	34.80
Antenna height (ft)	92.00	175.00
Orientation loss (dB)	0.00	0.00
TX line model	Coax Cable	Coax Cable
TX line length (ft)	170.00	261.00
Frequency (MHz)	11200.00	
Polarization	Horizontal	
Path length (mi)	2.27	
Free space loss (dB)	124.69	
Atmospheric absorption loss (dB)	0.06	
Net path loss (dB)	55.15	55.15
Radio model	MW Radio 11 GHz	MW Radio 11 GHz
Emission designator	10M0D7W	10M0D7W
Climatic factor	1.00	
Terrain roughness (ft)	20.00	
C factor	3.29	
Average annual temperature (°F)	43.86	
Fade occurrence factor (Po)	1.074E-003	
Polarization	Horizontal	
Rain region	Portland, Maine	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
<b>128QAM 50 Mbps</b>	<b>28.50</b>	<b>28.50</b>	<b>-71.75</b>	<b>-71.75</b>	<b>63.30</b>	<b>63.30</b>	<b>-26.65</b>	<b>-26.65</b>	<b>45.10</b>	<b>45.10</b>	<b>45.10</b>	<b>45.10</b>
64QAM 45 Mbps	29.00	29.00	-73.75	-73.75	63.80	63.80	-26.15	-26.15	47.60	47.60	47.60	47.60
32QAM 35 Mbps	29.00	29.00	-77.25	-77.25	63.80	63.80	-26.15	-26.15	51.10	51.10	51.10	51.10
16QAM 28 Mbps	29.00	29.00	-80.75	-80.75	63.80	63.80	-26.15	-26.15	54.60	54.60	54.60	54.60
QPSK 12 Mbps	29.50	29.50	-90.25	-90.25	64.30	64.30	-25.65	-25.65	64.60	64.60	64.60	64.60

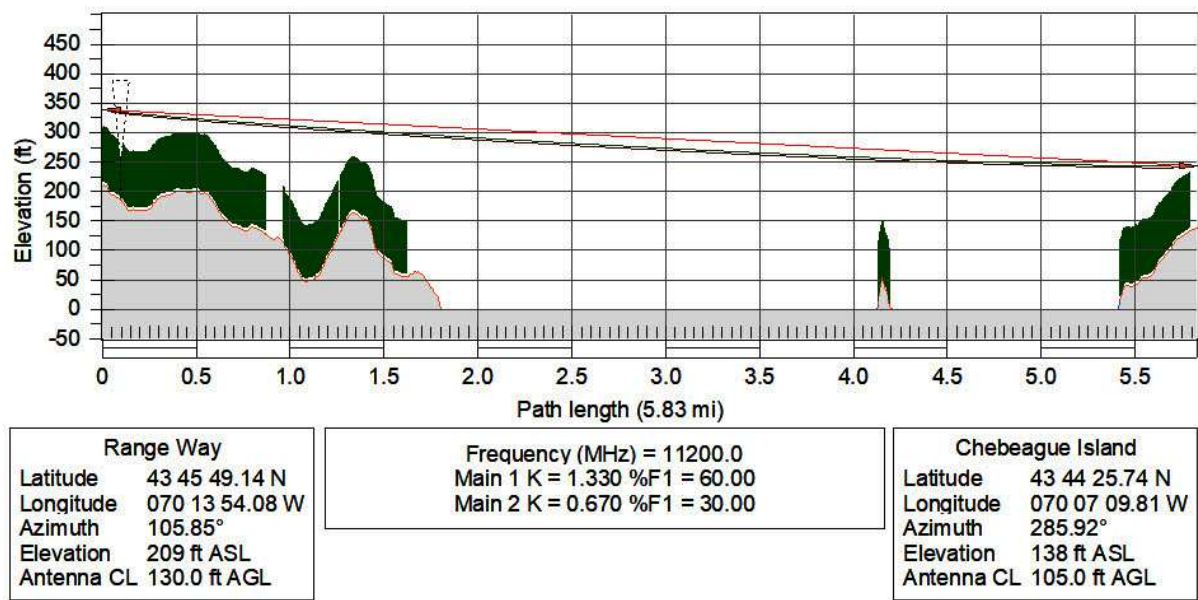
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
<b>128QAM 50 Mbps</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>
64QAM 45 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
32QAM 35 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16QAM 28 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 12 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000

Multipath fading method - Vigants - Barnett  
Rain fading method - Crane

**NOTE: Actual RSL is within +/- 2 dB of calculated RSL**

4.2 RANGE WAY TO CHEBEAGUE ISLAND

4.2.1 PATH PROFILE FOR THE PATH FROM RANGE WAY TO CHEBEAGUE ISLAND



**Comments:** The 5.8-mile path starts at the higher elevation of the site, Range Way. As the path propagates, the elevation decreases through the rough terrain. The elevation then steadily begins to increase after crossing the ocean until eventually ending at the higher elevation of the site, Chebeague Island. Along the path, the area is rural-residential and wooded with both deciduous and evergreen trees. There is an existing 200 ft SST that belongs to SBA. This tower is approximately 150 ft NE off-path from the main beam. Care should be taken if the location of the Range Way changes to avoid this structure from blocking the path toward Chebeague Island.

4.2.2 — RANGE WAY TO CHEBEAGUE ISLAND

	Range Way	Chebeague Island
Latitude	43 45 49.14 N	43 44 25.74 N
Longitude	070 13 54.08 W	070 07 09.81 W
True azimuth (°)	105.85	285.92
Vertical angle (°)	-0.21	0.15
Elevation (ft)	208.70	138.27
Tower height (ft)	180.00	120.00
Tower type	self supporting	self supporting
Antenna model	2 FT Antenna (TR)	2 FT Antenna (TR)
Antenna gain (dBi)	34.80	34.80
Antenna height (ft)	130.00	105.00
Orientation loss (dB)	0.00	0.00
TX line model	Coax Cable	Coax Cable
TX line length (ft)	212.00	226.00
Frequency (MHz)	11200.00	
Polarization	Horizontal	
Path length (mi)	5.83	
Free space loss (dB)	132.90	
Atmospheric absorption loss (dB)	0.15	
Net path loss (dB)	63.44	63.44
Radio model	MW Radio 11GHz	MW Radio 11GHz
Emission designator	10M0D7W	10M0D7W
Climatic factor	1.00	
Terrain roughness (ft)	36.10	
C factor	1.53	
Average annual temperature (°F)	44.05	
Fade occurrence factor (Po)	8.470E-003	
Polarization	Horizontal	
Rain region	Portland, Maine	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
<b>128QAM 50 Mbps</b>	<b>28.50</b>	<b>28.50</b>	<b>-71.75</b>	<b>-71.75</b>	<b>63.30</b>	<b>63.30</b>	<b>-34.94</b>	<b>-34.94</b>	<b>36.81</b>	<b>36.81</b>	<b>36.81</b>	<b>36.81</b>
64QAM 45 Mbps	29.00	29.00	-73.75	-73.75	63.80	63.80	-34.44	-34.44	39.31	39.31	39.31	39.31
32QAM 35 Mbps	29.00	29.00	-77.25	-77.25	63.80	63.80	-34.44	-34.44	42.81	42.81	42.81	42.81
16QAM 28 Mbps	29.00	29.00	-80.75	-80.75	63.80	63.80	-34.44	-34.44	46.31	46.31	46.31	46.31
QPSK 12 Mbps	29.50	29.50	-90.25	-90.25	64.30	64.30	-33.94	-33.94	56.31	56.31	56.31	56.31

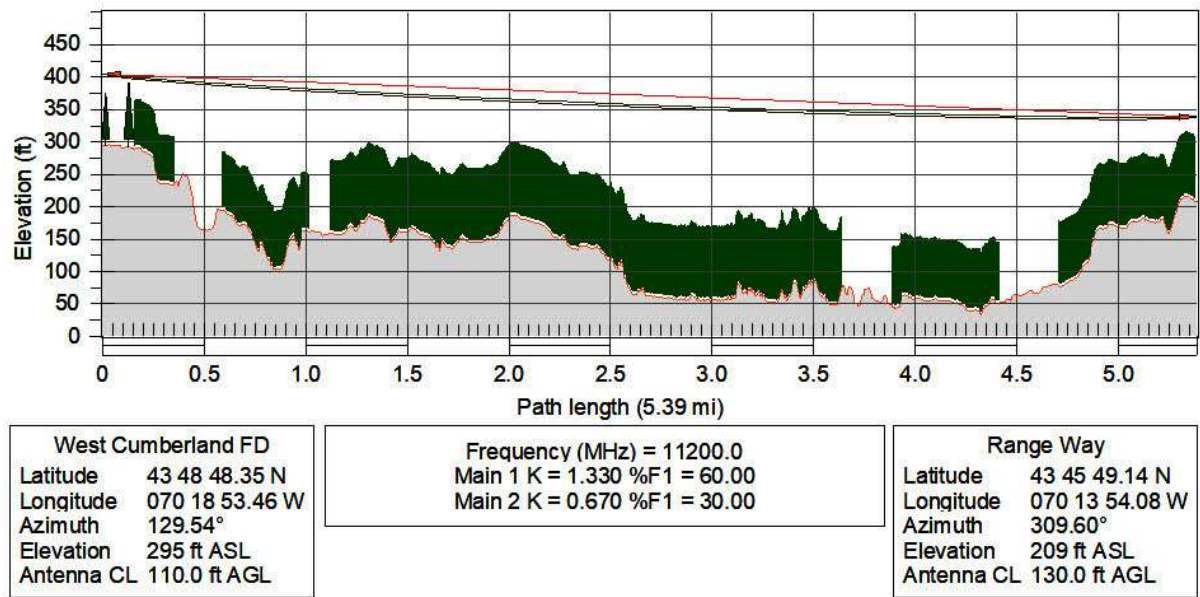
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
<b>128QAM 50 Mbps</b>	<b>99.9998</b>	<b>99.9998</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9998</b>	<b>99.9998</b>	<b>99.9998</b>	<b>99.9998</b>
64QAM 45 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9998	0.0001
32QAM 35 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
16QAM 28 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 12 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000

Multipath fading method - Vigants - Barnett  
Rain fading method - Crane

**NOTE: Actual RSL is within +/- 2 dB of calculated RSL**

4.3 WEST CUMBERLAND FD TO RANGE WAY

4.3.1 PATH PROFILE FOR THE PATH FROM WEST CUMBERLAND FD TO RANGE WAY



**Comments:** The 5.4-mile path starts at the higher elevation of the site, West Cumberland. As the path propagates, the elevation decreases through the rough terrain. The elevation then steadily begins to increase through Cumberland, ME until eventually ending at the higher elevation of the site, Range Way. Along the path, the area is rural-residential and wooded with both deciduous and evergreen trees.



4.3.2 — WEST CUMBERLAND FD TO RANGE WAY

	West Cumberland FD	Range Way
Latitude	43 48 48.35 N	43 45 49.14 N
Longitude	070 18 53.46 W	070 13 54.08 W
True azimuth (°)	129.54	309.60
Vertical angle (°)	-0.16	0.10
Elevation (ft)	294.62	208.70
Tower height (ft)	15.00	180.00
Tower type		self supporting
Antenna model	2 FT Antenna (TR)	2 FT Antenna (TR)
Antenna gain (dBi)	34.80	34.80
Antenna height (ft)	110.00	130.00
Orientation loss (dB)	0.00	0.00
TX line model	Coax Cable	Coax Cable
TX line length (ft)	190.00	212.00
Frequency (MHz)	11200.00	
Polarization	Horizontal	
Path length (mi)	5.39	
Free space loss (dB)	132.21	
Atmospheric absorption loss (dB)	0.14	
Net path loss (dB)	62.75	62.75
Radio model	MW Radio 11 GHz	MW Radio 11 GHz
Emission designator	10M0D7W	10M0D7W
Climatic factor	1.00	
Terrain roughness (ft)	41.26	
C factor	1.28	
Average annual temperature (°F)	43.79	
Fade occurrence factor (Po)	5.623E-003	
Polarization	Horizontal	
Rain region	Portland, Maine	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
<b>128QAM 50 Mbps</b>	<b>28.50</b>	<b>28.50</b>	<b>-71.75</b>	<b>-71.75</b>	<b>63.30</b>	<b>63.30</b>	<b>-34.25</b>	<b>-34.25</b>	<b>37.50</b>	<b>37.50</b>	<b>37.50</b>	<b>37.50</b>
64QAM 45 Mbps	29.00	29.00	-73.75	-73.75	63.80	63.80	-33.75	-33.75	40.00	40.00	40.00	40.00
32QAM 35 Mbps	29.00	29.00	-77.25	-77.25	63.80	63.80	-33.75	-33.75	43.50	43.50	43.50	43.50
16QAM 28 Mbps	29.00	29.00	-80.75	-80.75	63.80	63.80	-33.75	-33.75	47.00	47.00	47.00	47.00
QPSK 12 Mbps	29.50	29.50	-90.25	-90.25	64.30	64.30	-33.25	-33.25	57.00	57.00	57.00	57.00

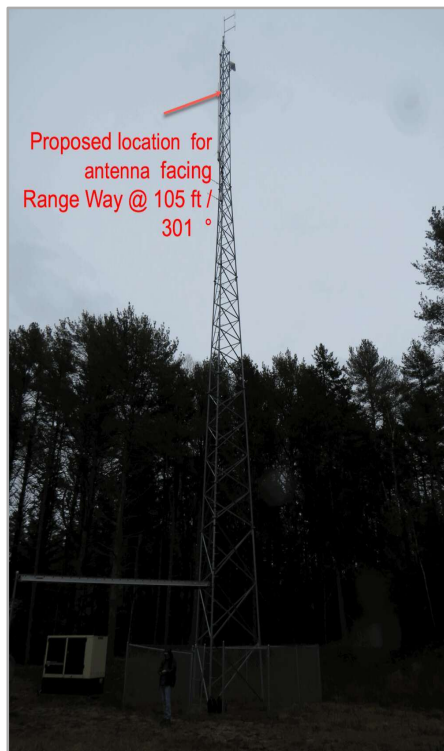
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
<b>128QAM 50 Mbps</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9999</b>	<b>99.9998</b>	<b>99.9998</b>
64QAM 45 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
32QAM 35 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16QAM 28 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 12 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000

Multipath fading method - Vigants - Barnett  
Rain fading method - Crane

**NOTE: Actual RSL is within +/- 2 dB of calculated RSL**

## 5.1 PROPOSED SYSTEM AT CHEBEAGUE ISLAND

### 5.1.1 Proposed Antenna(s) at Chebeague Island



Main antenna at Chebeague Island facing Range Way: 2 FT Antenna, 105 ft AGL, facing 301 Mag, transmit 11200H MHz, receive 11200H MHz



## 5.2 PROPOSED SYSTEM AT GOLF COURSE

### 5.2.1 Proposed Antenna(s) at Golf Course



Main antenna at Golf Course facing Range Way: 2 FT Antenna, 92 ft AGL, facing 183 Mag, transmit 11200H MHz, receive 11200H MHz

**5.3 PROPOSED SYSTEM AT RANGE WAY****5.3.1 Proposed Antenna(s) at Range Way**

To Be Built

Main antenna at Range Way facing Golf Course: 2 FT Antenna, 175 ft AGL, facing 3 Mag, transmit 11200H MHz, receive 11200H MHz

Main antenna at Range Way facing Chebeague Island: 2 FT Antenna, 130 ft AGL, facing 121 Mag, transmit 11200H MHz, receive 11200H MHz

Main antenna at Range Way facing West Cumberland FD: 2 FT Antenna, 130 ft AGL, facing 326 Mag, transmit 11200H MHz, receive 11200H MHz

#### **5.4 PROPOSED SYSTEM AT WEST CUMBERLAND FD**

##### **5.4.1 Proposed Antenna(s) at West Cumberland FD**

To Be Built

Main antenna at West Cumberland FD facing Range Way: 2 FT Antenna, 110 ft AGL, facing 146 Mag, transmit 11200H MHz, receive 11200H MHz