<u>**Amendment Application Appendix**</u>

I. Section 25.221 Declaration of Conformity

II. Section 25.222 Declaration of Conformity

III. C-band Radiation Hazard Study

IV. Ku-band Radiation Hazard Study

HARRIS CAPROCK

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FCC Declaration of Conformity

1. Harris CapRock Communications, Inc. ("Harris CapRock") designs, develops and manufactures marine stabilized antenna systems for satellite communications at sea. These products are then used by our customers as part of their Earth Station on Vessel ("ESV") networks.

2. Section 25.221 of the Commission's rules, 47 C.F.R. § 25.221, defines the provisions for blanket licensing of ESV antennas operating in the C-band. This declaration covers the requirements for meeting § 25.221(a)(1) by the demonstrations outlined in paragraphs (b)(1)(i) and (b)(1)(iii). The requirements for meeting § 25.221(a)(3)-(a)(13) are left to the applicant. The paragraph numbers in this declaration refer to the 2014 version of FCC 47 C.F.R. § 25.221.

3. Harris CapRock hereby declares that the antennas listed below will meet the off-axis EIRP spectral density requirements of § 25.221(a)(1)(i) with an N value of 1, when the following Input Power spectral density limitations are met:
   - 2.4 Meter C-Band, Model ST5000 is limited to: -2.7 dBW/4kHz

4. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will maintain a stabilization pointing accuracy of better than 0.2 degrees under specified ship motion conditions, thus meeting the requirements of § 25.221(a)(1)(ii)(A). The Input Power spectral density limits for this antenna have been adjusted to meet the requirements of § 25.221(a)(1)(ii)(B).

5. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will automatically cease transmission within 100 milliseconds if the pointing error should exceed 0.5 degrees and will not resume transmission until the error drops below 0.2 degrees, thus meeting the requirements of § 25.221(a)(1)(iii).

6. Harris CapRock maintains all relevant test data, which is available upon request, to verify these declarations.

By: [signature]

Name: ANDREW LUCAS

Title: CTO, CAPROCK

Harris CapRock Communications, Inc.

Date: 20th Nov 2015

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FCC Declaration of Conformity

1. Harris CapRock Communications, Inc. ("Harris CapRock") designs, develops and manufactures marine stabilized antenna systems for satellite communications at sea. These products are then used by our customers as part of their Earth Station on Vessel ("ESV") networks.

2. Section 25.222 of the Commission's rules, 47 C.F.R. § 25.222, defines the provisions for blanket licensing of ESV antennas operating in the Ku-band. This declaration covers the requirements for meeting § 25.222(a)(1) by the demonstrations outlined in paragraphs (b)(1)(i) and (b)(1)(iii). The requirements for meeting § 25.222(a)(3)-(a)(7) are left to the applicant. The paragraph numbers in this declaration refer to the 2014 version of FCC 47 C.F.R. § 25.222.

3. Harris CapRock hereby declares that the antennas listed below will meet the off-axis EIRP spectral density requirements of § 25.222(a)(1)(i) with an N value of 1, when the following Input Power spectral density limitations are met:
   - 2.4 Meter Ku-Band, Model ST5000 is limited to: -14.0 dBW/4kHz

4. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will maintain a stabilization pointing accuracy of better than 0.2 degrees under specified ship motion conditions, thus meeting the requirements of § 25.222(a)(1)(ii)(A). The Input Power spectral density limits for this antenna have been adjusted to meet the requirements of § 25.222(a)(1)(ii)(B).

5. Harris CapRock hereby declares that the antenna referenced in paragraph 3 above, will automatically cease transmission within 100 milliseconds if the pointing error should exceed 0.5 degrees and will not resume transmission until the error drops below 0.2 degrees, thus meeting the requirements of § 25.222(a)(1)(iii).

6. Harris CapRock maintains all relevant test data, which is available upon request, to verify these declarations.

By: [signature]

Name: ANDREW LUCAS

Title: CTO, CAPROCK

Harris CapRock Communications, Inc.

Date: 20 Nov 2015

Radiation Hazard Study

ST5000.2.4m (C-band)

This study analyzes the non-ionizing radiation levels for the Harris CapRock tri-band ST5000-2.4 antenna while operating in the C-band. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01.

Bulletin No. 65 specifies that there are two separate tiers of exposure limits that are depending on the area of exposure and/or the status of the individuals who are subject to the exposure -- the General Population/ Uncontrolled Environment and the Controlled Environment, where the general population cannot access.

The maximum level of non-ionizing radiation to which individuals may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm^2) averaged over any 6 minute period in a controlled environment, and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm^2) averaged over any 30 minute period in a uncontrolled environment.

In the normal range of transmit powers for satellite antennas, the power densities at or around the antenna surface are expected to exceed safe levels. The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameters:	Value	Unit	Symbol
Antenna Diameter	2.4	m	*D*
Antenna Transmit Gain	38.0	dBi	*G*
Transmit Frequency	6137.5	MHz	*f*
Antenna Feed Flange diameter	30	cm	*d*
Power Input to the Antenna	221	W	*P*

Calculated Parameters:
The following values were calculated using the above input parameters and the corresponding formulas:

Parameter	Value	Unit	Symbol	Formula
Antenna Surface Area	4.524	m^2	*A*	$\pi D^2/4$
Area of Antenna Flange	706.86	cm^2	*a*	$\pi d^2/4$
Antenna Efficiency	0.27		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor	6309.573		*g*	$10^{G/10}$
Wavelength	0.0489	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance
The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

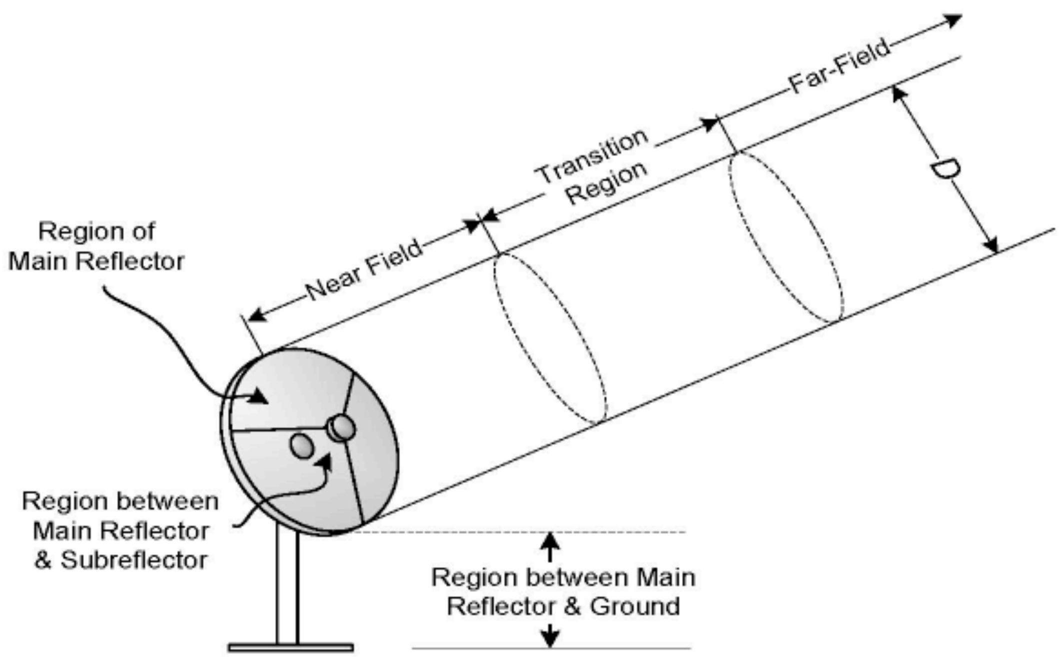

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, farfield and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near-Field Distance	29.46	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far-Field	70.70	m	$R_{ff} = 0.60D^2/(\lambda)$
Distance of Transition Region	29.46	m	$R_t = R_{nf}$

The distance in the transition region is between the near and far fields. Thus, $R_{nf} \leq R_t \leq R_{ff}$. However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations

The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	5.187	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	2.222	mW/cm^2	S_{ff}	$GP/(4\pi\ Rff^2)$
Power Density in the Transition Region	5.187	mW/cm^2	S_t	$S_{nf}\ R_{nf}/(R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	1251.84	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	19.56	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density b/w Reflector and Ground	4.89	mW/cm^2	S_g	P / A

The below table summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Density	Value	Unit	Controlled Environment
Far Field Calculation	2.222	mW/cm^2	Satisfies FCC MPE
Near Field Calculation	5.187	mW/cm^2	Exceeds Limits
Transition Region	5.187	mW/cm^2	Exceeds Limits
Region b/w feed iris and reflector	1251.84	mW/cm^2	Exceeds Limits
Main Reflector Region	19.56	mW/cm^2	Exceeds Limits
Region b/w Main Reflector & Ground	4.89	mW/cm^2	Satisfies FCC MPE

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.

Radiation Hazard Study

ST5000.2.4m (Ku-band)

This study analyzes the non-ionizing radiation levels for the Harris CapRock tri-band ST5000-2.4 antenna while operating in the Ku-band. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01.

Bulletin No. 65 specifies that there are two separate tiers of exposure limits that are depending on the area of exposure and/or the status of the individuals who are subject to the exposure -- the General Population/ Uncontrolled Environment and the Controlled Environment, where the general population cannot access.

The maximum level of non-ionizing radiation to which individuals may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm^2) averaged over any 6 minute period in a controlled environment, and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm^2) averaged over any 30 minute period in a uncontrolled environment.

In the normal range of transmit powers for satellite antennas, the power densities at or around the antenna surface are expected to exceed safe levels. The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameters:	Value	Unit	Symbol
Antenna Diameter	2.4	m	*D*
Antenna Transmit Gain	43.5	dBi	*G*
Transmit Frequency	14125	MHz	*f*
Antenna Feed Flange diameter	12	cm	*d*
Power Input to the Antenna	221	W	*P*

Calculated Parameters:
The following values were calculated using the above input parameters and the corresponding formulas:

Parameter	Value	Unit	Symbol	Formula
Antenna Surface Area	4.524	m^2	A	$\pi D^2/4$
Area of Antenna Flange	113.18	cm^2	a	$\pi d^2/4$
Antenna Efficiency	0.18		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor	22387.21		g	$10^{G/10}$
Wavelength	0.0212	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance
The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

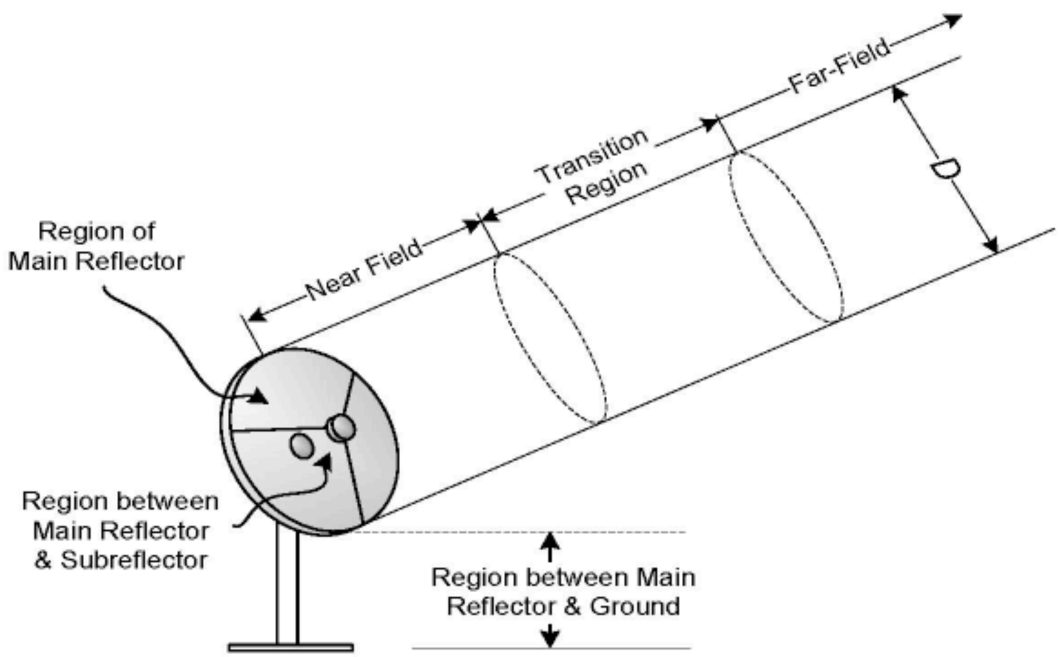

Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, farfield and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near-Field Distance	67.8	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far-Field	162.72	m	$R_{ff} = 0.60D^2/(\lambda)$
Distance of Transition Region	67.8	m	$R_t = R_{nf}$

The distance in the transition region is between the near and far fields. Thus, $R_{nf} \leq R_t \leq R_{ff}$. However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations

The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	3.479	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	1.490	mW/cm^2	S_{ff}	$GP/(4\pi\ Rff^2)$
Power Density in the Transition Region	3.479	mW/cm^2	S_t	$S_{nf}\ R_{nf}/(R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	7832.9	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	19.582	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density b/w Reflector and Ground	4.896	mW/cm^2	S_g	P / A

The below table summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Density	Value	Unit	Controlled Environment
Far Field Calculation	1.490	mW/cm^2	Satisfies FCC MPE
Near Field Calculation	3.479	mW/cm^2	Satisfies FCC MPE
Transition Region	3.479	mW/cm^2	Satisfies FCC MPE
Region b/w feed iris and reflector	7832.9	mW/cm^2	Exceeds Limits
Main Reflector Region	19.582	mW/cm^2	Exceeds Limits
Region b/w Main Reflector & Ground	4.896	mW/cm^2	Satisfies FCC MPE

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.