ISAT US Inc.
FCC Form 312
Exhibit C
Response to Question Q28

1. Radiation Hazard Analysis for the antenna manufactured by JRC, model: JUE-60GX

This section analyzes the non-ionizing radiation levels for the JUE-60GX earth station included in this application. The analysis and calculations performed in this Exhibit 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.

Bulletin No. 65 and the FCC R&O 96-326 specifies two Maximum Permissible Exposure (MPE) limits that are dependent on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. These are described below:

- General Population/Uncontrolled environment MPE limit is 1 mW/cm^2. The General Population / Uncontrolled MPE is a function of transmit frequency and is for an exposure period of thirty minutes or less.
- Occupational/Controlled environment MPE limit is 5 mW/cm^2. The Occupational MPE is a function of transmit frequency and is for an exposure period of six minutes or less.

The analysis provided in this report determined the power flux density levels of the earth station in the 1) far-field, 2) near-field, 3) transition region, 4) region between the feed and main reflector surface, 5) at the main reflector surface, and 6) between the antenna edge and the ground.

Section 1.1 – Detailed calculations

Input Parameter	Value	Units	Symbol
Antenna Diameter	0.65	m	D
Antenna Transmit Gain	43.9	dBi	G
Transmit Frequency	30000	MHz	f
Antenna Feed Flange Diameter	4	cm	d
Power Input to the Antenna	5	Watts	P

Calculated Parameter	Value	Units	Symbol	Formula
Antenna Surface Area	0.3318	m^2	A	$\pi D^2/4$
Area of Antenna Flange	12.5660	cm^2	a	$\pi d^2/4$
Antenna Efficiency	0.5887	real	η	$g\lambda^2/(\pi^2 D^2)$
Gain Factor	24547.0892	real	g	10^(G/10)
Wavelength	0.0100	m	λ	300/f

Antenna Field Distances

Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	10.5625	m	Rnf	$D^2/(4\lambda)$
Distance to Far-Field	25.35	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	10.5625	m	Rt	Rt=Rnf

Power Flux Density

Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	3.5483	mW/cm^2	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	1.5199	mW/cm^2	Sff	$gP/(4\pi Rff^2)$
Power Density in the Transition Region	3.5483	mW/cm^2	St	Snf*Rnf/Rt
Power Density at the Feed Flange	1591.5964	mW/cm^2	Sfa	4P/a
Power Density at Main Reflector	6.0273	mW/cm^2	Ssurface	4P/A
Power Density between Reflector and Ground	1.5068	mW/cm^2	Sg	P/A

Section 1.2 – Summary of Results

Region	Calculated Power Density (mW/cm^2)	Limit Controlled Environment ≤ 5 mW/cm^2	Limit Uncontrolled Environment ≤ 1 mW/cm^2
Near Field	3.5483	meets limit	exceeds limit
Far Field	1.5199	meets limit	exceeds limit
Transition Region	3.5483	meets limit	exceeds limit
Feed Flange	1591.5964	exceeds limit	exceeds limit
Main Reflector	6.0273	exceeds limit	exceeds limit
Between Reflector and Ground	1.5068	meets limit	exceeds limit

As summarized in the above tables, the JUE-60GX antenna meets the FCC's MPE levels for controlled environments except for at the feed flange and at the main reflector. Since the antenna will be enclosed within a radome, these areas will not be accessible while the antenna is in operation. Training of personnel with access to the antenna would include consideration of the operation mode of the antenna and information on how to prevent radiation exposure, including disabling the communications system. When maintenance of the antenna is required and the radome is removed, the trained technicians will turn off the transmit power before performing work in these areas. In addition, the antenna will be installed at an elevation that is not accessible by the general population on the vessels, and any areas where the limits for uncontrolled environments could be exceeded will be restricted to trained personnel. Therefore, the general population will be protected.

In conclusion, the results show that the JUE-60GX antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in § 1.1310 of the Regulations. Moreover,

the applicant agrees to 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.

2. Radiation Hazard Analysis for the antenna manufactured by Cobham SatCom, model: Sailor 100 GX

This section analyzes the non-ionizing radiation levels for the Sailor 100 GX earth station included in this application. The analysis and calculations performed in this Exhibit 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.

Bulletin No. 65 and the FCC R&O 96-326 specifies two Maximum Permissible Exposure (MPE) limits that are dependent on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. These are described below:

- General Population/Uncontrolled environment MPE limit is 1 mW/cm^2. The General Population / Uncontrolled MPE is a function of transmit frequency and is for an exposure period of thirty minutes or less.
- Occupational/Controlled environment MPE limit is 5 mW/cm^2. The Occupational MPE is a function of transmit frequency and is for an exposure period of six minutes or less.

The analysis provided in this report determined the power flux density levels of the earth station in the 1) far-field, 2) near-field, 3) transition region, 4) region between the feed and main reflector surface, 5) at the main reflector surface, and 6) between the antenna edge and the ground.

Section 2.1 – Detailed calculations

Input Parameter	Value	Units	Symbol	
Antenna Diameter	1.03	m	D	
Antenna Transmit Gain	47.2	dBi	G	
Transmit Frequency	30000	MHz	F	
Antenna Feed Flange Diameter	4	Cm	D	
Power Input to the Antenna	5	Watts	P	
Calculated Parameter	Value	Units	Symbol	Formula
Antenna Surface Area	0.8332	m^2	A	$\pi D^2/4$
Area of Antenna Flange	12.566	cm^2	A	$\pi d^2/4$
Antenna Efficiency	0.5012	Real	H	$g\lambda^2/(\pi^2 D^2)$
Gain Factor	52480.7460	Real	G	10^(G/10)
Wavelength	0.0100	m	Λ	300/f
Antenna Field Distances				
Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	26.5225	m	Rnf	$D^2/(4\lambda)$

Distance to Far-Field	63.654	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	26.5225	m	Rt	Rt=Rnf

Power Density

Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	1.2032	mW/cm^2	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	0.5154	mW/cm^2	Sff	$gP/(4\pi Rff^2)$
Power Density in the Transition Region	1.2032	mW/cm^2	St	Snf*Rnf/Rt
Power Density at the Feed Flange	1591.5964	mW/cm^2	Sfa	4P/a
Power Density at Main Reflector	2.4004	mW/cm^2	Ssurface	4P/A
Power Density between Reflector and Ground	0.6001	mW/cm^2	Sg	P/A

Section 2.2 – Summary of Results

Region	Calculated Power Density (mW/cm^2)	Limit Controlled Environment ≤ 5 mW/cm^2	Limit Uncontrolled Environment ≤ 1 mW/cm^2
Near Field	1.2032	meets limit	exceeds limit
Far Field	0.5154	meets limit	meets limit
Transition Region	1.2032	meets limit	exceeds limit
Feed Flange	1591.5964	exceeds limit	exceeds limit
Main Reflector	2.4004	meets limit	exceeds limit
Between Reflector and Ground	0.6001	meets limit	meets limit

As summarized in the above table, the Sailor 100 GX antenna meets the FCC's MPE levels for controlled environments except for at the feed flange of the antenna. Since the antenna will be enclosed within a radome, the feed flange area will not be accessible while the antenna is in operation. Training of personnel with access to the antenna would include consideration of the operation mode of the antenna and information on how to prevent radiation exposure, including disabling the communications system. When maintenance of the antenna is required and the radome is removed, the trained technicians will turn off the transmit power before performing work in these areas. In addition, the antenna will be installed at an elevation that is not accessible by the general population on the vessels, and any areas where the limits for uncontrolled environments could be exceeded will be restricted to trained personnel. Therefore, the general population will be protected.

In conclusion, the results show that the Sailor 100 GX antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in § 1.1310 of the Regulations. Moreover, the applicant agrees to 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.