ISAT US Inc. FCC
Form 312 Exhibit C
Radiation Hazard Analysis

1.0 Introduction

This Exhibit analyzes the non-ionizing radiation levels for the Cobham8100GX 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 specify 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 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. The summary of results and discussion are provided in Section 2, and the detailed analyses are provided in Section 3.

2.0 – Summary of Results

The Table below summarize the results for the proposed Cobham8100 GX. The terminals proposed in this application are for commercial and government uses and intended to be operated by professional personnel. The analysis of the non-ionizing radiation levels, provided in Section 3, assumed the maximum allowed input power to antenna of 5W and a 100% duty cycle resulting in worst case radiation levels. In a significant number of deployments the terminal duty cycle would be below 100% and the actual power required would be lower than the 5W maximum resulting in lower radiation levels than those calculated. As with any directional antenna the maximum level of non-ionizing radiation is in the main beam of the antenna that is pointed to the satellite. As one moves around the antenna to the side lobes and back lobes the radiation levels decrease significantly. Thus, the maximum radiation level from an antenna occurs in a limited area in the direction the antenna is pointed to. The terminal proposed in this application is designed to cease transmitting if the receive signal from the satellite is blocked, which could be caused by a person standing in front of the terminal or from other blockage. If the receive signal is blocked, the transmitter is shut down and will not resume operating until the signal from the satellite is reacquired. This operational feature of the terminal minimizes the potential for radiation exposure. In addition, in a controlled environment personnel with access to the antenna will be trained on the operational modes of the antenna and procedures are put in place to ensure that a safe distance is maintained from the antenna while in operation and that the terminal is turned off prior to any maintenance being conducted. Furthermore, the manuals for these terminals will explicitly indicate the precautions, such has not standing in front of the terminal, that are necessary to prevent radiation exposure.

Region	Distance (m)	Calculated Power Density (mW/cm^2)	Limit Controlled Environment ≤ 5 mW/cm^2	Limit Uncontrolled Environment ≤ 1 mW/cm^2
Near Field	24.6	1.8	Meets Limit	Exceeds Limit
Far Field	59.0	0.8	Meets Limit	Meets Limit
Transition Region	24.6	1.8	Meets Limit	Exceeds Limit
Main Reflector	NA	2.5	Meets Limit	Exceeds Limit

3.0 – Detailed calculations

Input Parameter	Value	Units	Symbol
Antenna Diameter	1.0	m	D
Antenna Transmit Gain	48.2	dBi	G
Transmit Frequency	29500	MHz	f
Antenna Feed Flange Diameter	5.9	cm	d
Power Input to the Antenna	5.0	Watts	P

Calculated Parameter	Value	Units	Symbol	Formula
Antenna Surface Area	0.79	m^2	A	$\pi D^2/4$
Area of Antenna Flange	27.15	cm^2	a	$\pi d^2/4$
Antenna Efficiency	0.69	real	η	$g\lambda^2/(\pi^2 D^2)$
Gain Factor	66069.34	real	g	10^(G/10)
Wavelength	0.01	m	λ	300/f

Antenna Field Definitions

Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	24.6	m	Rnf	$D^2/(4\lambda)$
Distance to Far-Field	59.0	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	24.6	m	Rt	Rt=Rnf

Power Flux Density	Value	Units	Symbol	Formula
Power Density in the Near Field	1.8	mW/cm^2	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	0.8	mW/cm^2	Sff	$gP/(4\pi Rff^2)$
Power Density in the Transition Region	1.8	mW/cm^2	St	Snf*Rnf/Rt

Flange Power Density table

Calculated Parameter	Value	Units	Symbol	Formula
Power Density at the Feed Flange	736.5	mW/cm^2	Sfa	4P/a

Main Reflector Power Density table

Calculated Parameter	Value	Units	Symbol	Formula
Power Density at Main Reflector	2.5	mW/cm^2	Ssurface	4P/A

Main Reflector Power Density table

Calculated Parameter	Value	Units	Symbol	Formula
Power Density between Reflector and Ground	0.64	mW/cm^2	Sg	P/A