ISAT US Inc.

FCC Form 312 Exhibit C

L3 GCS Panther II 60 and Panther II 96 Radiation Hazard Analysis

I. Introduction

This Exhibit analyzes the non-ionizing radiation levels for the two L3 GCS Panther II terminal earth stations 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/cm2. 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/cm2. 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, and 3) transition region. The analysis also examined the safe distance required to meet both the controlled and uncontrolled exposure limits. The summary of results and discussion is provided in Section 2 and the detailed analyses are provided in Section 3.

II. Summary of Results

The Tables below summarize the results for the proposed Panther II terminals. The analysis of the non-ionizing radiation levels, provided in Section 3, assumed the maximum allowed input power to antenna of 7W 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 7W 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. This is especially true in the case of the Panther II terminals, as they utilize small, dish antennas that result in a very narrow main beam, resulting in higher calculated power density in the main beam but a sharp drop off in energy as one moves toward the side lobes.

The Panther II terminals are for commercial and government use and are not intended to be operated by the general public. The terminal is cost prohibitive for purchase by the general public, therefore it will only be operated by trained professional personnel. The antenna installers will be aware of the antenna's radiation environment and use measures best suited to maximize protection to anyone who may come into the proximity of the terminal.

As summarized in the tables below, the Panther II 60 terminal meets the FCC's MPE levels for uncontrolled or controlled environments beyond separation distances of about 34.16 m and 15.28 m, respectively. The Panther II 96 terminal meets the FCC's MPE levels for uncontrolled or controlled environments beyond separation distances of about 57.02 m and 25.50 m, respectively. Based on these calculations, the Panther II 60 meets the FCC's MPE level for controlled environments in the far field and slightly exceeds the level for controlled environments in the near field and transition region of the antenna. The Panther II 60 exceeds the MPE levels for uncontrolled environments in the near field, far field and the transition region of the antenna. The Panther II 96 meets the FCC's MPE levels for controlled environments in the near field, far field, and transition region. The Panther II 96 only slightly exceeds the MPE levels for uncontrolled environments in the far field region and exceeds the MPE levels for uncontrolled environments in the near field and transition regions. Training of personnel with access to the terminal would include consideration of the operational modes of the antenna and information on how to prevent radiation exposure, including disabling the communications system.

Additionally, there are various safety features associated with the operation and installation of the terminals that will prevent radiation exposure. For example, the terminals are 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 nearly instantaneously and will not resume operating until the signal from the satellite is reacquired. In fact there is a double shut down protection in the event that someone or something obstructs the RF path to the satellite. Not only does the terminal automatically turn off its Transmit capability if it loses the satellite Receive signal, i.e. the transmission path is compromised, but the radio frequency amplifier is additionally muted via its monitor and control so that no radio frequency can be transmitted. Especially given the small size of these antennas and their operational elevation angle, there is a high probability that any person passing close enough to the antenna to be exposed to its main beam would also block the RF path between the terminal and the satellite triggering the automatic shutdown mechanism. As a result of this automatic shutdown mechanism, the maximum continuous time that a person could be exposed to the main beam transmissions at any power level would be significantly less than one second before the antenna would cease transmitting.

The antenna will be operated only at locations not accessible by the general population. Given that the antenna will not operate below elevation angles of five degrees, and that the terminal will be pointed upward toward the satellite - persons are unlikely to be exposed to the main beam of the antenna. Any areas where the limits for uncontrolled environments could be exceeded will be restricted to trained personnel. Furthermore, the manuals for these terminals will provide warnings regarding potential for radiation hazard.

In conclusion, the results of the analysis combined with the design and operational characteristics of the terminals show that the Panther II terminals, when deployed, and used under the proper mitigation procedures, meet the guidelines specified in § 1.1310 of the Regulations.

Panther II 60 Terminal

Region	Distance (m)	Calculated Power Density (mW/cm2)	Limit Controlled Environment ≤ 5 mW/cm2	Limit Uncontrolled Environment ≤ 1 mW/cm2
Safe Range for Uncontrolled	≥34.16	1.0	Meets Limit	Meets Limit
Safe Range for Controlled	≥15.28	5.0	Meets Limit	Exceeds Limit
Near Field	9.00	5.84	Exceeds Limit	Exceeds Limit
Far Field	21.60	2.5	Meets Limit	Exceeds Limit
Transition Region	9.00	5.84	Exceeds Limit	Exceeds Limit

Panther II 96 Terminal

Region	Distance (m)	Calculated Power Density (mW/cm2)	Limit Controlled Environment ≤ 5 mW/cm2	Limit Uncontrolled Environment ≤ 1 mW/cm2
Safe Range for Uncontrolled	≥57.02	1.0	Meets Limit	Meets Limit
Safe Range for Controlled	≥25.50	5.0	Meets Limit	Exceeds Limit
Near Field	23.04	2.48	Meets Limit	Exceeds Limit
Far Field	55.3	1.06	Meets Limit	Exceeds Limit
Transition Region	23.04	2.48	Meets Limit	Exceeds Limit

III. Detailed Calculations

Panther II 60 Terminal

Input Parameter	Value	Units	Symbol
Antenna Diameter	0.6	m	D
Antenna Transmit Gain	43.21	dBi	G
Transmit Frequency	30000	MHz	f
Power Input to the Antenna	7	Watts	P

Calculated Parameter	Value	Units	Symbol	Formula
Antenna Efficiency	0.59	real	η	$g\lambda^2/(\pi^2 D^2)$
Gain Factor	20941.12	real	g	10^(G/10)
Wavelength	0.01	m	λ	300/f

Antenna Field Distancs				
Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	9.00	m	Rnf	$D^2/(4\lambda)$
Distance to Far-Field	21.60	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	9.00	m	Rt	Rt=Rnf

Power Flux Density				
Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	5.84	mW/cm^2	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	2.50	mW/cm^2	Sff	$gP/(4\pi Rff^2)$
Power Density in the Transition Region	5.84	mW/cm^2	St	Snf*Rnf/Rt

Panther II 96 Terminal

Input Parameter	Value	Units	Symbol
Antenna Diameter	0.96	m	D
Antenna Transmit Gain	47.66	dBi	G
Transmit Frequency	30000	MHz	f
Power Input to the Antenna	7	Watts	P

Calculated Parameter	Value	Units	Symbol	Formula
Antenna Efficiency	0.64	real	η	$g\lambda^2/(\pi^2 D^2)$
Gain Factor	58344.51	real	g	10^(G/10)
Wavelength	0.01	m	λ	300/f

Antenna Field Distances				
Calculated Parameter	Value	Units	Symbol	Formula
Near-Field Distance	23.04	m	Rnf	$D^2/(4\lambda)$
Distance to Far-Field	55.30	m	Rff	$0.6D^2/\lambda$
Distance of Transition Range	23.04	m	Rt	Rt=Rnf

Power Flux Density				
Calculated Parameter	Value	Units	Symbol	Formula
Power Density in the Near Field	2.48	mW/cm^2	Snf	$16\eta P/(\pi D^2)$
Power Density in the Far Field	1.06	mW/cm^2	Sff	$gP/(4\pi Rff^2)$
Power Density in the Transition Region	2.48	mW/cm^2	St	Snf*Rnf/Rt