CESIUM

Radiation Hazard Analysis
Nightingale 1 Demonstration

Rev. A

CesiumAstro, Inc.
13215 Bee Cave Parkway Suite A-300
Austin, Texas 78738

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1 PURPOSE

A radiation hazard analysis was performed for the Cesium Nightingale 1 (NG1) transmitter to verify minimal safe operating distances to ensure public safety during demonstrations.

2 RADIO ANALYSES

The NG1 was analyzed using the operational specifications for this demonstration. These calculations provide validation for the results listed. For analyses involving power density calculations, the following equation is used:

$$\mathrm{P} = \frac{p_t g_t}{4\pi r^2}$$

P is the power density of the antenna (W/m^2) at a given distance r (m), p_t is the output power of the antenna (W), and g_t is the gain of the antenna. The distance r is the minimum safe distance from the antenna to the target area, and this equation is inverted to solve for r.

The analysis below defines the minimum safe working distance for both Occupational and General Public, which are based on the maximum permissible exposure limits of 5 mW/cm^2 and 1 mW/cm^2 respectively.

2.1 NIGHTINGALE 1

The Cesium NG1 is an experimental Ka-band active phased antenna system. For demonstration operations, the antenna will be operated in a controlled area. Only persons authorized to operate this antenna will be allowed access to equipment pertaining to control and operation the NG1 system. In addition, the transmitter will be rendered inoperable before and after the intended operational periods, and the area will be monitored during operation to ensure that personnel and the general public are clear of any radiation hazard area. This antenna will only be operating when commanded by Cesium personnel for demonstration purposes.

Transmitter Power (dBm):	10
Transmitter Power (W):	0.01
Maximum Antenna Gain (dBi):	27
Non-dimensional Antenna Gain:	501.19
ERP (dBm):	33.9
ERP (W):	2.45

Minimum Safe Distance		
	Occupational	General Public
Meters:	0.09	0.2
Feet:	0.3	0.66

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