

APPLICATION FOR EXPERIMENTAL AUTHORITY

Description

BlackSky Global LLC ("BlackSky") seeks experimental authority to support integration and testing of satellite components during construction on the ground. The satellite production requires specific testing with certain signals which cannot be emulated in the ground. Therefore, BlackSky proposes to use a FoxCom INMARSAT BGAN antenna mounted atop a building located at its Tukwila test facility and repeat them via a coax-based repeater kit to the engineering and assembly areas within its facility. The BGAN antenna will communicate with the INMARSAT 4-F3 GSO satellite at 98° W.L. between 1626.5 and 1675 MHz.

Antenna

The antenna will be mounted less than 2 meters above the rooftop of the existing building.

The RF signal is provided by an amplification unit with an expected maximum output power of 38 dBm, which is equal to 6.3 W. The transmit antenna is a directional circular aperture/patch antenna with a gain of 10 dBi and estimated diameter of 0.5 meters. See Figure 1. It shall be installed on an office building rooftop and pointed at 149 degrees azimuth and 31 degrees elevation.



Figure 1: Transmit L-band antenna

Stop Buzzer Contact

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Radiation Exposure Analysis

The analysis below (see Table 1) was done as per FCC OET Bulletin 65 (Edition 97-01, dated August 1997), which provides guidance on calculating RF power densities with respect to FCC RF radiation exposure limits (47 CFR § 1.1310).

A transmit frequency of 1626.5 MHz is assumed for conservatism in the analysis, as this yields slightly higher power densities, though the results of the analysis do not significantly change across expected transmit frequencies (1626.5 to 1675 MHz). Furthermore, also out of conservatism, it is assumed that the coaxial cable between the amplification unit and antenna is lossless. RF power supplied to the antenna input – 38 dBm or 6.3 W – is rounded up to 7 W.

Table 1 shows the transmitter is expected to generate RF power densities in excess of the General Population Maximum Permissible Exposure limits (for frequencies > 1500 MHz) of 1 mW/cm², in both the near field and in the far field (on-axis). Concerning the on-axis far field power densities, please note that since the antenna will be pointing at 31 degrees elevation, most individuals will be off-axis and thus be exposed to lower power densities. For example, since the antenna has a half-power beamwidth of 60 degrees (30 degrees on either side of axis) an individual at the same height as the antenna will be exposed to at most half the maximum power density (~1.1 mW/cm²).

The installation will not generate RF power densities of the Occupational Maximum Permissible Exposure limits of 5 mW/cm².

Parameter	Symbol	Formula	Value	Units	Notes
Largest antenna dimension	D	Input	0.5	m	Estimate of antenna diameter
Antenna input power	P	Input	7	W	Max TX gain + Max Input Power = 58 dB + (-20 dBm) = 38 dBm = ~7 W
Max antenna gain	G_max	Input	10	dBi	
Frequency	F	Input	1626.5	MHz	
Wavelength	lambda	300/F	0.184445128	m	
Antenna gain (linear)	G	10 ^(G_max/10)	10	unitless	
Effective isotropic radiated power	EIRP	P*G	70	W	
Far-field region distance	R_ff	0.6*D ² /lambda	0.81325	m	Eq. 16 of FCC OET Bulletin 65
Max on-axis far-field power density	S_ff	0.64*EIRP/(pi*R ²)	21.56155097	W/m ²	Eq. 7 of FCC OET Bulletin 65; accounts for rooftop reflections.
			2.156155097	mW/cm ²	
Minimum safe distance for General Population	D_gp	Sqrt(0.64*EIRP/10/pi)	1.194164264	m	
Near-field region distance	R_nf	D ² /2/(4*lambda)	0.338854167	m	Eq. 12 of FCC OET Bulletin 65
Antenna efficiency	eta	(G*lambda ² /24/pi)/(pi*D ² /4)	0.137877887	unitless	Eq. 14 of FCC OET Bulletin 65
Max near-field power density	S_nf	16*eta*P/(pi*D ²)	19.66177679	W/m ²	Eq. 13 of FCC OET Bulletin 65
			1.966177679	mW/cm ²	

Table 1: Power density calculations

As noted above, the installation is expected to exceed General Population Maximum Permissible Exposure. As such, Category 2 mitigation measures will be undertaken as per 47 CFR § 1.1307(b)(4).

The transmitter is located on the rooftop of an office building and as such will not be accessible by the general public. Nevertheless, signage compliant to 7 CFR § 1.1307(b)(4) will be posted near the antenna.