

Government Contract Information and Expedited Processing Request

Northrop Grumman Systems Corp. (“NGSC”) hereby requests expedited review for Special Temporary Authority to operate a fixed experimental radio station facility, as detailed below and in the application. NGSC is developing systems for the Department of Defense. The authorization requested herein is necessary to allow NGSC to test equipment for the U.S. Navy Unmanned Combat Airship (“NUCAS”) under contract no. HR0011-6-9-0001.

The proposed fixed experimental radio station facilities will utilize a GPS Networking Repeater Kit, model L1L2HNRRKIT, to re-radiate the GPS signal. The re-radiated signal will remain within a shielded building. The repeater kit will re-radiate GPS frequencies L1 at 1575.42 MHz and L2 at 1227.60 MHz, with an emission designator of 20M4M1D and a power of 0.100000mw EIRP. The stop buzzer contact for the program to terminate operations is Mr. David Cunningham at wireless number (310) 505-8155.

Please refer to the table and calculations below for the link budget analysis to compute the EIRP at a 100 foot distance from the radiating element.

GPS L1 Link Budget

Satellite Transmitter

Transmitter Power (25 Watts)	14.25	dBW	
RF Losses in transmitter path	-1.25	dB	
Antenna Gain (with respect to an isotropic radiator)	13.5	dB	
Satellite EIRP (wrt isotropic radiator)	26.50	dBW	446.68 Watts

Propagation

Atmospheric and Polarization Losses	-0.5	dB
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$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$
where d = distance from antenna = c = speed of light = f = frequency = lambda = wavelength = c/f = 2.52E+07 meters 3.00E+08 m/sec 1.58E+09 Hz 1.90E-01 meters
$= -10 \log_{10} [3.17E+08 / 1.90E-01]^2$
$= -10 \log_{10} [1.67E+09]^2$
Free Space Path Loss over Distance -184.43 dB

Received Power on Earth	-158.43	dBW	
	-128.43	dBm	1.44E-04 pW
Gain of Receive Antenna	38	dB	
RF losses in 300 feet of LMR400UF cabling and connectors from Receive Antenna to Line Amplifier	-6.7	dB	
Gain of Line Amplifier	20	dB	
RF Power at Input to Re-Radiating Antenna	-77.13	dBm	19.36 pW
Gain of Passive Re-Radiating Antenna	3	dB	
Re-Radiated EIRP (wrt isotropic radiator)	-74.13	dBm	38.64 pW
Re-Radiated ERP (wrt dipole radiator)	-76.28	dBm	23.55 pW

	$Free\ Space\ Path\ Loss = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$
where d = distance from antenna =	100 feet
	= $-10 \log_{10} [383.023 / 1.90E-01]^2$
	= $-10 \log_{10} [2.01E+03]^2$
Free Space Path Loss over Distance	-66.07 dB
RF power level at 100 ft distance =	-140.20 dBm wrt isotropic antenna
	-142.35 dBm wrt dipole antenna

GPS L2 Link Budget

Satellite Transmitter

Transmitter Power (4.32 Watts)	6.35	dBW	
RF Losses in transmitter path	-1.25	dB	
Antenna Gain (with respect to an isotropic radiator)	11.5	dB	
Satellite EIRP (wrt isotropic radiator)	16.60	dBW	45.71 Watts

Propagation

Atmospheric and Polarization Losses	-0.5	dB
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$\text{Free Space Path Loss} = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$			
where d = distance from antenna =	2.52E+07	meters	
c = speed of light =	3.00E+08	m/sec	
f = frequency =	1.23E+09	Hz	
lambda = wavelength = c/f =	2.44E-01	meters	
	= -10log ₁₀	[3.17E+08/ 2.44E-01] ²	
	= -10log ₁₀	[1.30E+09] ²	
Free Space Path Loss over Distance	-182.26	dB	

Received Power on Earth	-166.16	dBW	
	-136.16	dBm	2.42E-05 pW

Gain of Receive Antenna	38	dB	
RF losses in 300 feet of LMR400UF cabling and connectors from Receive Antenna to Line Amplifier	-6.7	dB	

Gain of Line Amplifier	20	dB	
RF Power at Input to Re-Radiating Antenna	-84.86	dBm	3.26 pW
Gain of Passive Re-Radiating Antenna	3	dB	

Re-Radiated EIRP (wrt isotropic radiator)	-81.86	dBm	6.51 pW
Re-Radiated ERP (wrt dipole radiator)	-84.01	dBm	3.97 pW

$$Free\ Space\ Path\ Loss = -10 \times \log_{10} \left[\left(\frac{4\pi d}{\lambda} \right)^2 \right]$$

where d = distance from antenna = 100 feet

= -10log₁₀ 383.022976/ 2.44E-01]²

= -10log₁₀ [1.57E+03]²

Free Space Path Loss over Distance -63.90 dB

RF power level at 100 ft distance = -145.77 dBm wrt isotropic antenna

-147.92 dBm wrt dipole antenna