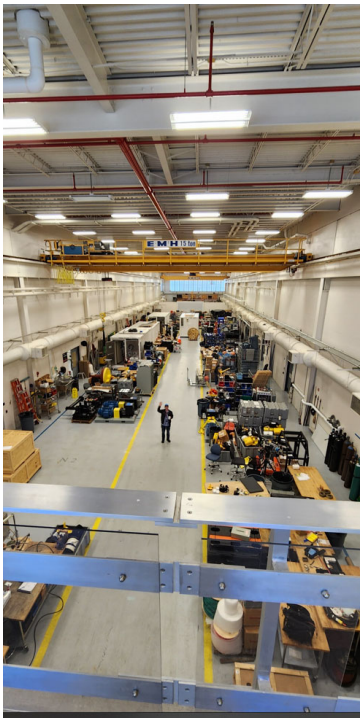
JHU/APL Bldg 12 GPS Reradiator

- Reradiator will be used to test equipment with GPS receivers while in development in an indoor high-bay area

JHU/APL Bldg 12

- Setup
  - GPS receive antenna/preamp is mounted on roof of building
  - 150-ft coax cable connects preamp to reradiator transmit antenna in center of high bay area

Bldg 12
High Bay Area

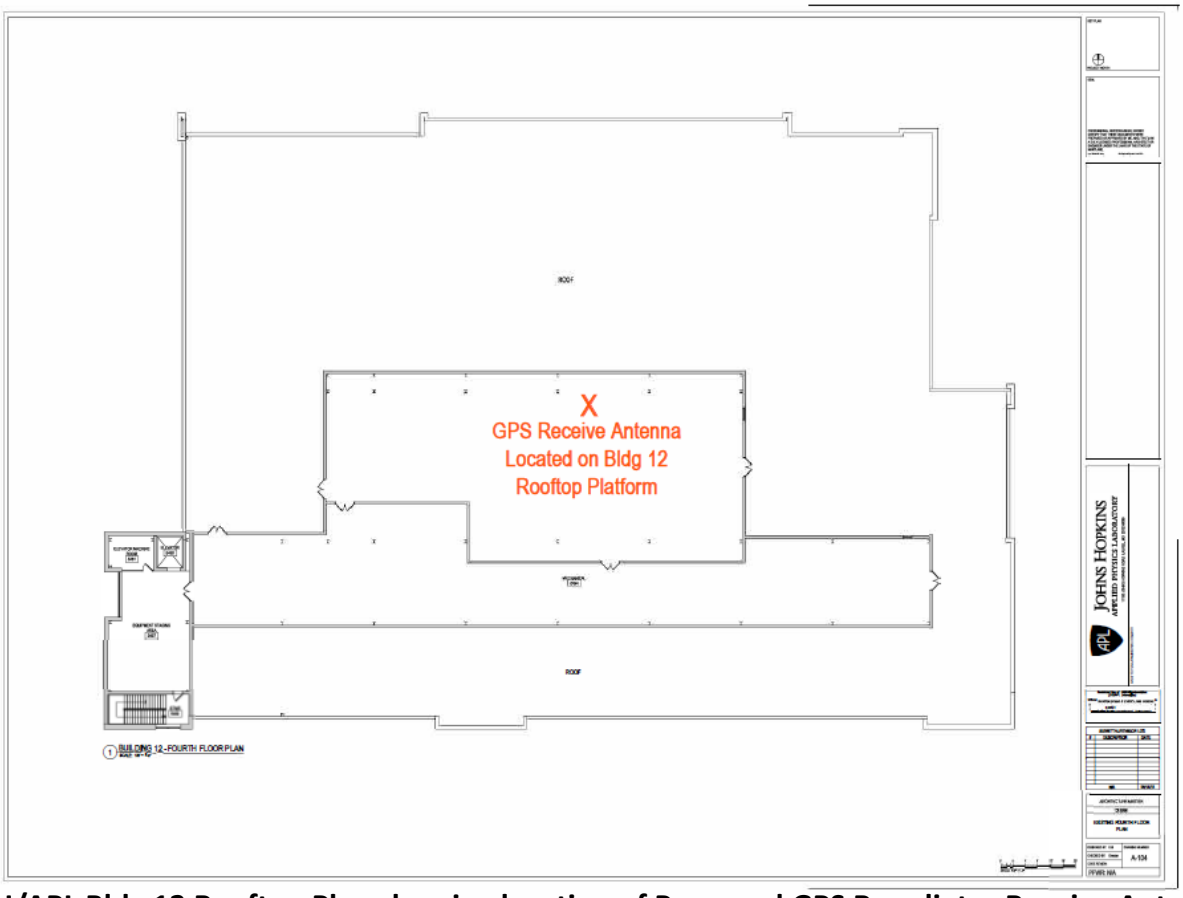


- Reradiator system
  - GPS Networking Model HNRRKIT
  - 30 dB Electronic Gain

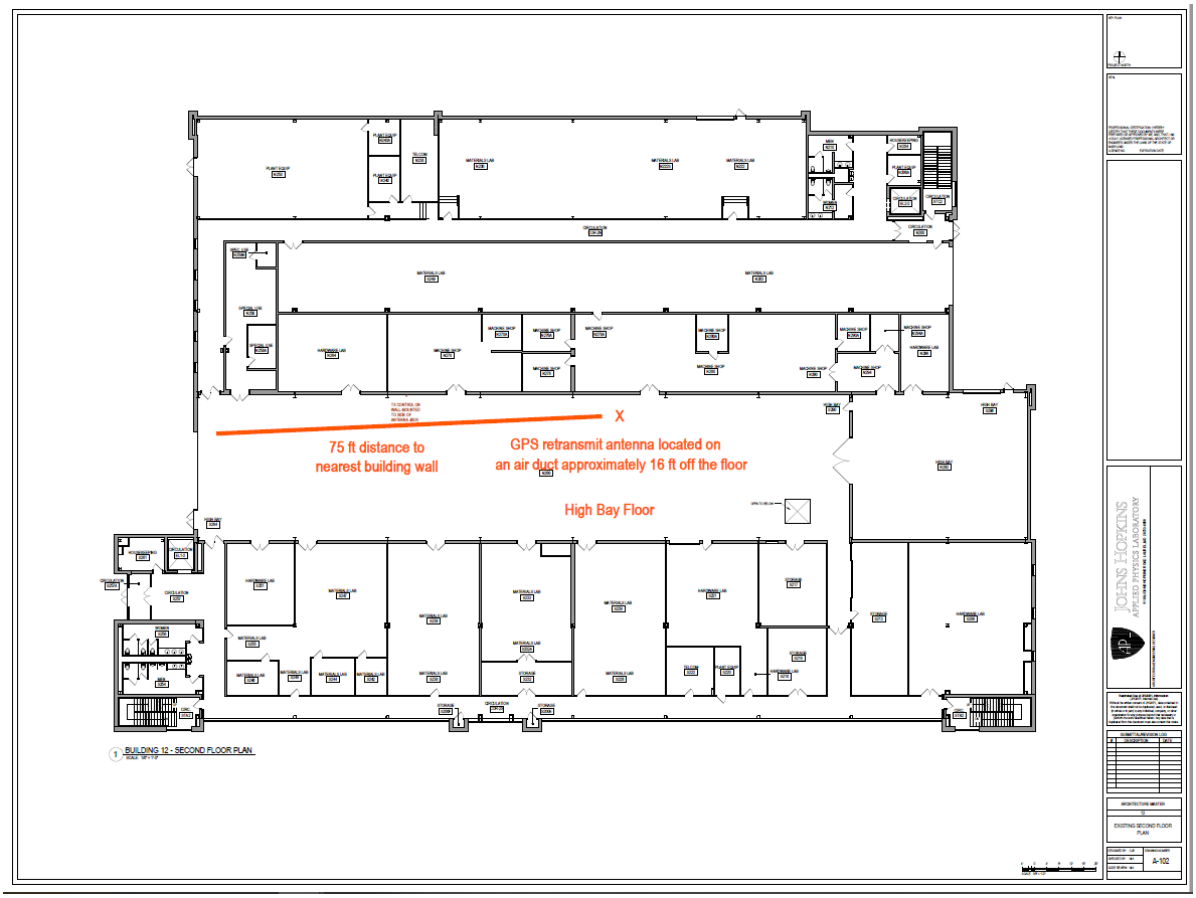
- Reradiator System "Stop Buzzer" POCs
  - Kevin Fleagle, 240-228-7202, Kevin.Fleagle@jhuapl.edu
  - Benjamin Barnhart: 240-228-2455, Benjamin.Barnhart@jhuapl.edu

GPS Networking
GPS Reradiator
Model HNRRKIT

Floor Plans



JHU/APL Bldg 12 Rooftop Plan showing location of Proposed GPS Reradiator Receive Antenna



JHU/APL Bldg 12 High Bay Plan showing location of Proposed GPS Reradiator Transmit Antenna

GPS Reradiator Clarification Questions

(from NTIA Manual Section 8.3.28)

a) Authorization request
- Proposed system is for use in the JHU/APL Bldg 12 High Bay area
- Authorization is for a single system

b) Frequency assignment and description of use
- Reradiator system will be used to test GPS receivers installed in equipment and enclosures under development and test in an indoor, high bay environment for a variety of government and military sponsors

c) Entering approved application into the NTIA GMF database
- JHU understands that the approved application will be entered into the GMF

d) Length of approved license
- JHU/APL understands that if approved, the reradiator will be licensed for 2 years, after which time review and renewal is required

e) Area of control around building housing reradiator system
- Bldg 12 is located well within the JHU/APL Laurel Campus fenced and secure perimeter. Distance from the building to the campus perimeter is >0.25mi

f) Reradiator power density calculations
- Link calculations that show reradiated GPS signals from the proposed system will comply with restrictions (-140 dBm at 100 ft from Bldg 12) are provided on the next page. Calculations show that the commercial system being purchased requires additional RF signal attenuation for compliance.

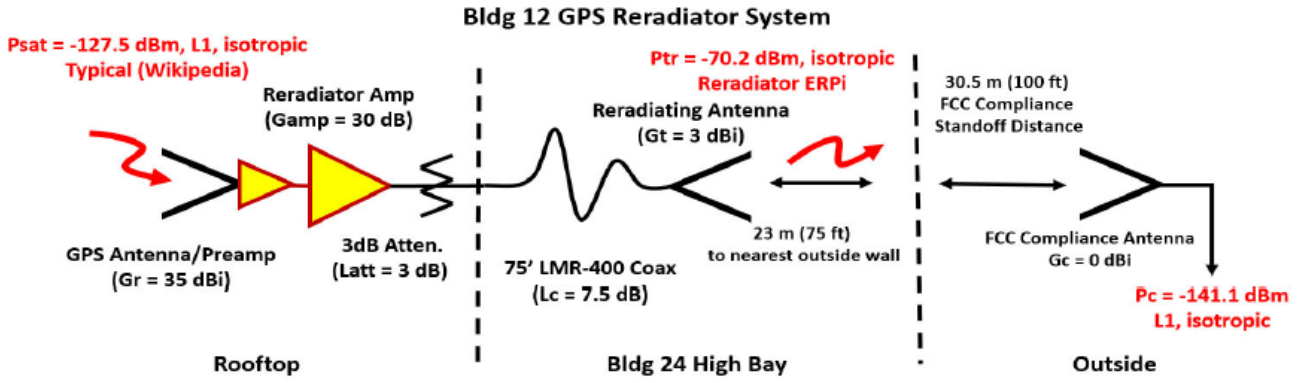
g) Notification of GPS repeater operation
- Signage will be posted in the vicinity of the reradiator of its use
- The JHU/APL campus first responders (Fire Department and Security Force) will be notified of its existence

h) Limitations of use
- JHU/APL understands that the sole purpose of the system is for testing of RNSS receivers and systems. Intentional amplification and transmission of non-RNSS signals with this system will not be allowed

i) Reradiator system “Stop Buzzer” POC
- Kevin Fleagle: 240-228-7202, Kevin.Fleagle@jhuapl.edu
- Benjamin Barnhart: 240-228-2455, Benjamin.Barnhart@jhuapl.edu

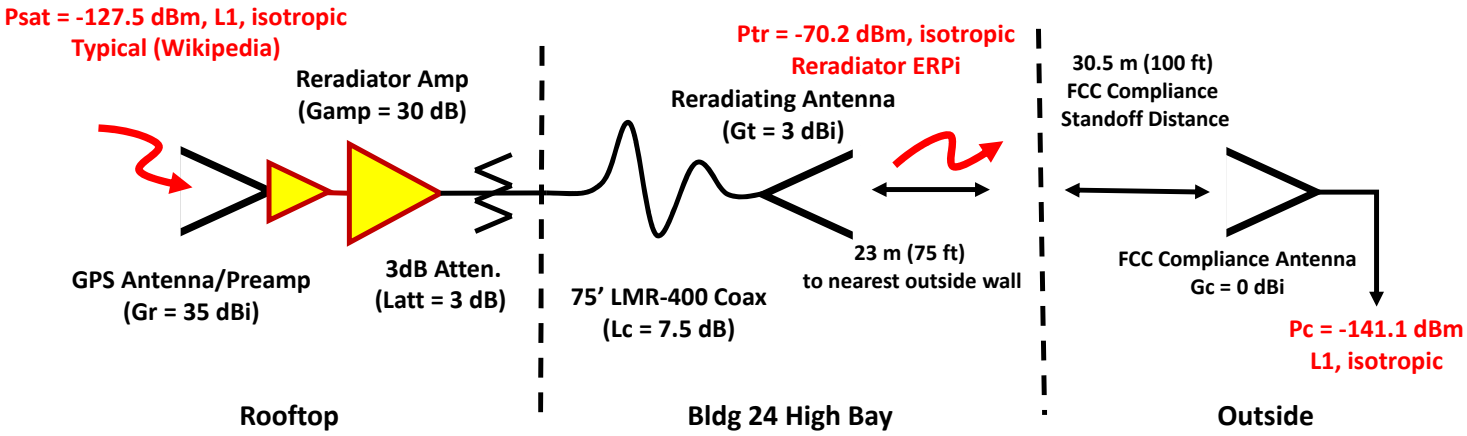
GPS Reradiator Compliance Calculations

JHU/APL Bldg 12 GPS Reradiator System Compliance Equations



Parameter	Notation	Value	Units	Notes
Received GPS L1 Satellite Power	**Psat**	**-127.5**	**dBm**	Ground Based Receiver, Typical (Wikipedia)
Reradiator System				
Rooftop Receive Antenna/Preamp	Grr	35.0	dBi	From HNRRKIT Spec Sheet
Reradiating Amplifier Gain	Gamp	30.0	dB	From HNRRKIT Spec Sheet
Fixed Attenuator Loss	Latt	3.0	dB	
Cable Length		150.0	ft	
Cable Unit Loss		5.1	dB/100 ft	LMR-400
Cable Loss	Lc	7.7	dB	
Transmit Antenna	Grt	3.0	dBi	From HNRRKIT Spec Sheet
Reradiator L1 Transmit ERPi	**Ptr**	**-70.2**	**dBm**	Psat + Grr + Gamp - Latt - Lc + Grt
		96.6	**pW**	
Path Loss Calculations				
GPS L1 Frequency		1575.4	MHz	
Reradiator Distance to Nearest Wall	Di	75.0	ft	
		22.9	m	
FCC Compliance Standoff Distance	Dc	100.0	ft	
		30.5	m	
Total Reradiator Path Loss @ L1	**Lp**	**70.9**	**dB**	20log10(f(Hz)) + 20log10(4pi/c) + 20log10(Di+Dc)
FCC Compliance Antenna Gain	Gc	0.0	dBi	
Total Reradiator Compliance Power Received	**Pc**	**-141.1**	**dBm**	Ptr - Lp + Gc
Max Reradiator Power 100 ft from Bldg 12 allowed by FCC		**-140.0**	**dBm**	√ Proposed system is compliant

Bldg 12 GPS Reradiator System



ɔn Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
1575.42000000- MHz	FX	9.600000 pW	19.200000 pW P	0.01000000 %	2M04W7D	1.023

Station Location

City	State	Latitude	Longitude	Mobile	Street (or other indication of location)	County	Radius of Operation
0 Herndon	Virginia	North 38 57 31	West 77 22 33		460 Herdon Parkway	FAIRFAX	

Datum: NAD 83

Is a directional antenna (other than radar) used? No

Exhibit submitted: No

(a) Width of beam in degrees at the half-power point:

(b) Orientation in horizontal plane (degrees from True North):

(c) Orientation in vertical plane (degrees from horizontal):

Will the antenna extend more than 6 meters above the ground, or if mounted on an existing building, will it extend more than 6 meters above the buil

building? No

(a) Overall height above ground to tip of antenna in meters:

(b) Elevation of ground at antenna site above mean sea level in meters:

(c) Distance to nearest aircraft landing area in kilometers:

(d) List any natural formations of existing man-made structures (hills, trees, water tanks, towers, etc.) which, in the opinion of the applicant, would t

Action	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
New	1227.60000000- MHz	FX	N/A 10.764600 pW	P		24M0G1D	

Action	Frequency	Station Class	Output Power/ERP	Mean Peak	Frequency Tolerance (+/-)	Emission Designator	Modulating Signal
New	1575.42000000- MHz	FX	N/A 20.511620 pW	P		24M0G1D	

Form 442 Confirmation Number:	EL794298
Form 442 File Number:	1344-EX-CN-2022
Date of Submission:	November 22, 2022

The administrative portion of the Form 442 has been submitted successfully to the OET Experimental Licensing Branch. Please print or record the following information and save for future reference:

Form 442 Confirmation Number: EL794298
Form 442 File Number: 1344-EX-CN-2022
Date of Submission: November 22, 2022

Important : You MUST write down the file and confirmation number to access your application after it is filed or if you exit. Otherwise you will need to START OVER and file a new application.

☐ **Please check this box to confirm you have written down the file and confirmation number and to proceed.**

Press this button to proceed to technical data.

Technical Data