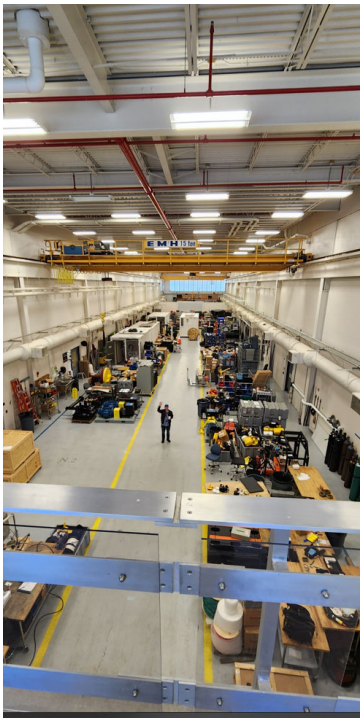
JHU/APL Bldg 12 GPS Reradiator

- 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
  - GPS Location:
    N 39°09'57, W 76°53’48

Bldg 12
High Bay Area

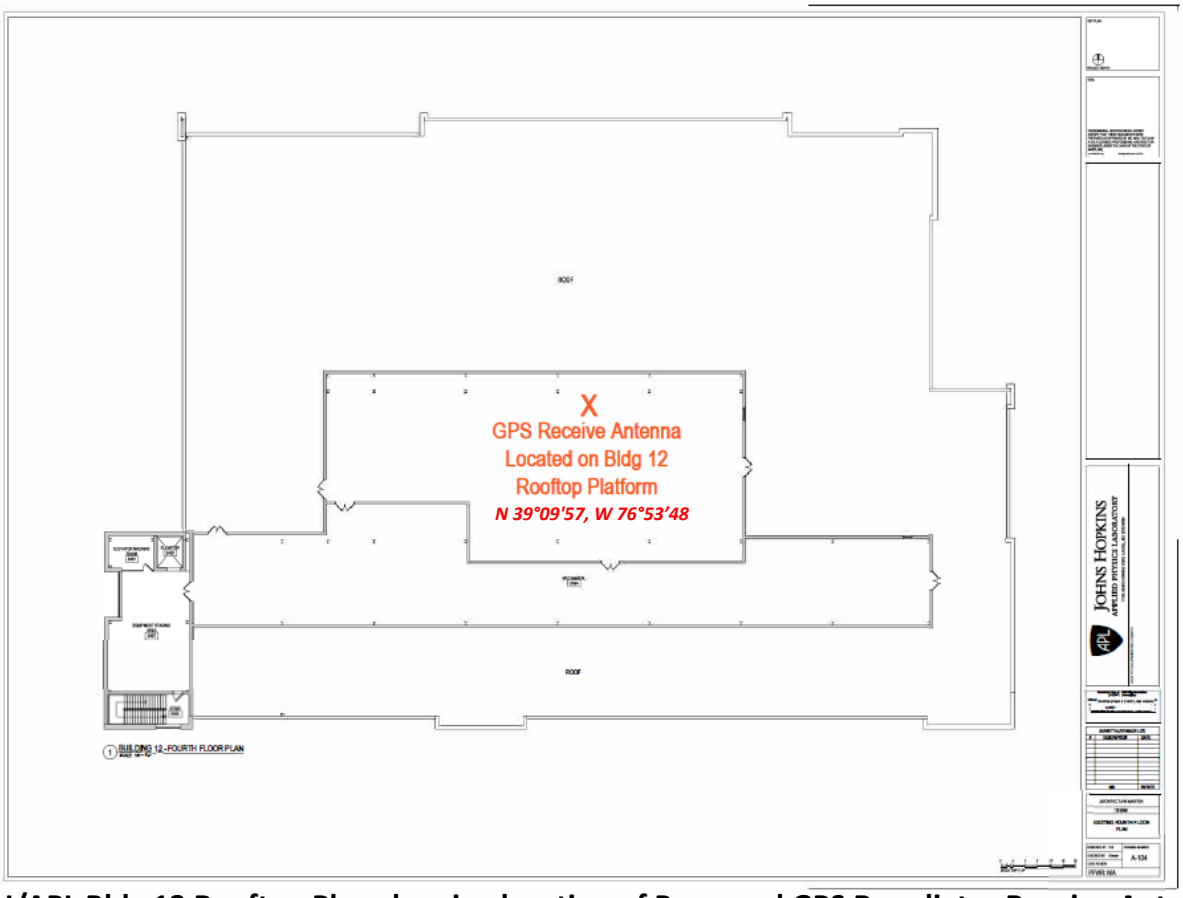


- Reradiator system
  - GPS Networking Model HNRRKIT
  - 35 dB Antenna/Preamp Gain
  - 30 dB Electronic Gain

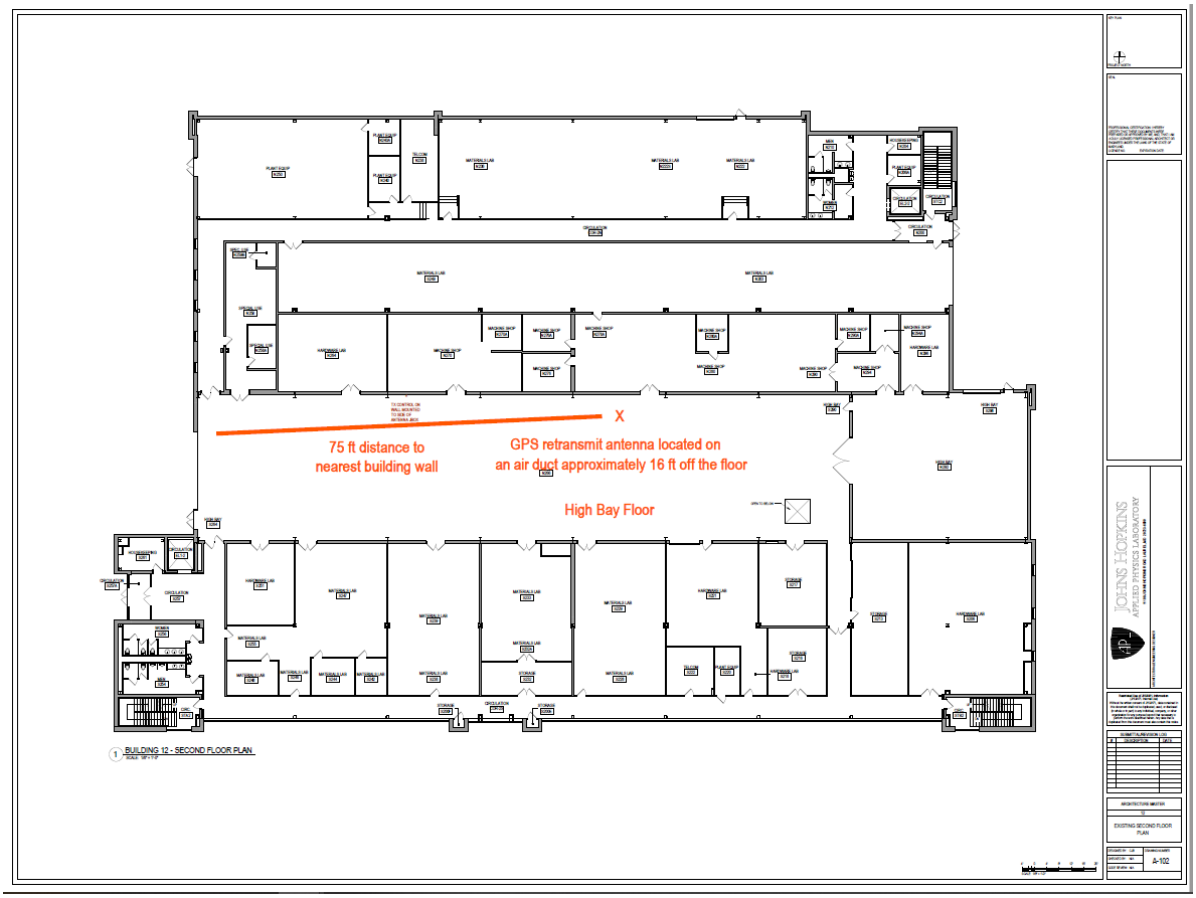
- Reradiator System “Stop Buzzer” POCs
  - Lalitto Sarker
    Lalitto.Sarker@jhuapl.edu
    240-636-2667
  - Eric Berkenpas
    Eric.Berkenpas@jhuapl.edu
    240-302-8818

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.

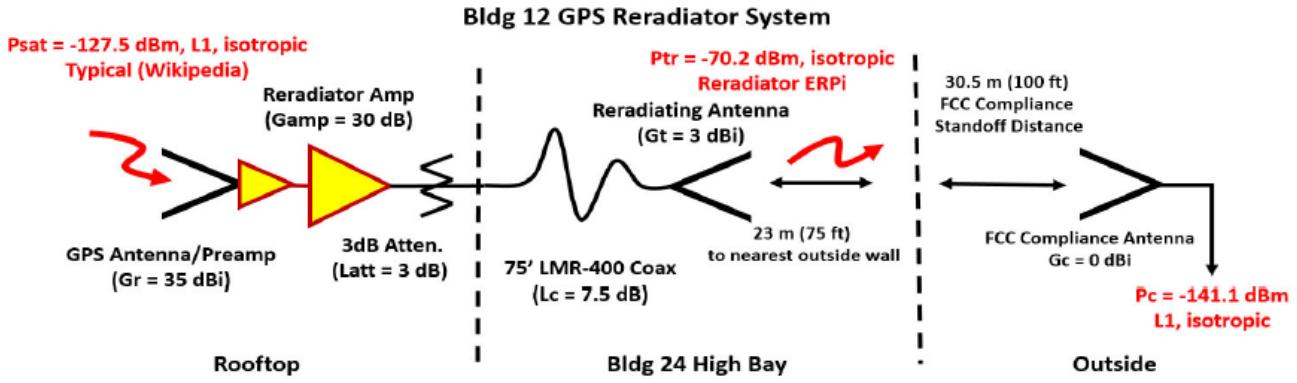
g) Notification of GPS repeater operation
- Signage will be posted in the vicinity of the reradiator to provide notification of its use
- The JHU/APL campus first responders (Fire Department and Security Force) will be notified of its existence

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” POCs
- Lalitto Sarker, Lalitto.Sarker@jhuapl.edu, 240-636-2667
- Eric Berkenpas, Eric.Berkenpas@jhuapl.edu, 240-302-8818

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