

Documentation of NTIA Manual Section 8.3.28, Use of Fixed Devices That Re-Radiate Signals Received From the Global Positioning System

Following please find Savi Networks responses which satisfy the points 1-9 in the NTIA Manual.

1. Individual authorization is for indoor use only, and is required for each device at a specific site.

Savi Networks understands and agrees that this authorization is for indoor use only, and is for just one specific GPS repeater at our site located at 1292 Anvilwood Ct, Sunnyvale, CA.

2. Applications for frequency assignment should be applied for as an XT station class with a note indicating the device is to be used as an "Experimental RNSS Test Equipment for the purpose of testing GPS receivers" and describing how the device will be used.

Savi Networks understands and agrees that this authorization is for an XT station class with the GPS repeater to be used as an "Experimental RNSS Test Equipment for the purpose of testing GPS receivers". The GPS repeater will be used indoors only, for testing proper operation of Savi Networks equipment which includes a GPS receiver. The Savi Networks equipment will be connected to a PC using a serial cable, then a self test performed including checking proper GPS receiver operation. The indoors GPS repeater will supply the test signals needed for this GPS receiver self test.

3. Approved applications for frequency assignment will be entered in the GMF.

Savi Networks understands and agrees that approved applications for frequency assignment will be entered in the GMF.

4. The maximum length of the assignment will be two years, with possible renewal.

Savi Networks understands and agrees that the maximum length of the assignment will be two years, with possible renewal.

5. The area of potential interference to GPS reception (e.g., military or contractor facility) has to be under the control of the user.

As documented in 6. below, the area of potential interference to GPS reception is limited to inside the Savi Networks building located at 1292 Anvilwood Ct, Sunnyvale, CA, as well as immediately outside this building but not extending past a distance of 100 feet from the building. This area is under the control of Savi Networks. Our building is kept locked and requires an employee badge for entry.

6. The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculations showing compliance with this requirement must be provided with the application for frequency assignment and should be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation.)

The Savi Networks site for this GPS repeater is located at 1292 Anvilwood Ct, Sunnyvale, CA. This building is 65 feet by 120 feet, as shown in Figure 1 below. The GPS repeater will be mounted in one corner of the building and oriented towards the center of the building. This means that the range of this repeater within the building is the hypotenuse of the building, which for 65x120 is 136 feet, calculated as $\sqrt{65^2 + 120^2}$

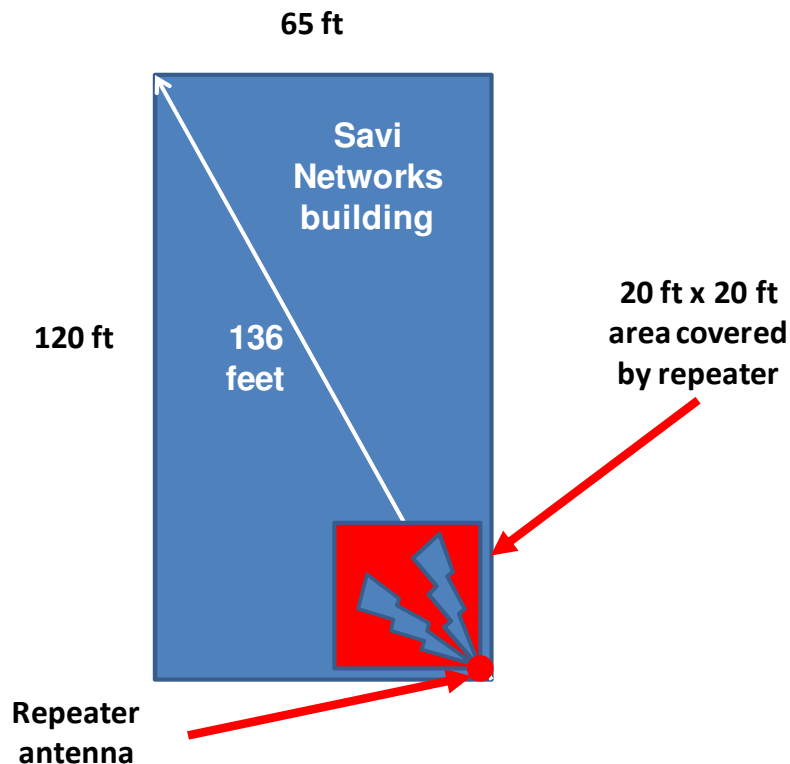


Figure 1. Savi Networks building, 1292 Anvilwood Ct, Sunnyvale, CA

The GPS signal level within the building, is determined by first calculating the cable loss from the passive outdoors GPS antenna to the active re-radiating indoors antenna, as shown by the calculations in Figure 2. This Figure uses the online GPS calculator from the website of GPS Source, the vendor from which Savi Networks is purchasing the GPS repeater and cable. The cable loss is shown to be 5.1 dB.

Coaxial Cable Attenuation & Power Handling Calculator

Product	Frequency (MHz)	Attenuation (db/100 feet)	Attenuation (db/100 mtrs)	Average Power (kW)
LMR-240	1575	10.127	33.226	0.19
Calculate		Run Length (feet)	Total Run Attenuation(dB)	Efficiency (%)
		50	5.1	31.2

Figure 2. GPS repeater cable loss

The GPS signal level within the building, is calculated using free space loss and not including loss from the internal walls in the building. The cable loss of 5.1 dB is applied as well as the building length of 136 feet, to calculate a signal power in the building of -135.86 dBm. This is shown by the calculations in Figure 3. This Figure uses the online GPS calculator from the website of GPS Source, the vendor from which Savi Networks is purchasing the GPS repeater and cable.

GPS Source, Inc. Repeater Budget Calculator

Change the values in the yellow boxes to calculate required readings

-140 dBm at 100 feet from the building to meet NTIA regulations

Receive Ant Gain	Ant Cable Insertion Loss	Repeater Amp Gain	Repeater Ant Gain (Best Case)	Range in Feet	Repeated Signal Power @ Range in dBm
35	-5.1	30	3	136	-135.86

GPS Carrier Frequency (MHz)	Free Space loss with Isotropic Antennas	Total System Gain	Range in Miles	Effective Radiated Power dBm
1575	68.76	59.9	0.03	-69.25

Avg Receive Power in dBm North America	Reference Dipole Gain	Transmitted Power (W)	Range in Kilometers	Effective Isotropic Radiated Power (dBm)
-130	2.15	6.0e-11	0.04	-67.10

Typical value @ L1: -130.0 dBm @ L2: -127.5 dBm

Range in Meters
41.4528

Figure 3. GPS repeated signal level inside Savi Networks building

The GPS signal level 100 feet from the building, is calculated using free space loss and not including loss from the external walls of the building. The cable loss of 5.1 dB is applied as well as the building length of 136 feet plus the distance from the building of 100 feet, to calculate a signal power 100 feet from the building of -140.65 dBm. This is shown by the calculations in Figure 4. This Figure uses the online GPS calculator from the website of GPS Source, the vendor from which Savi Networks is purchasing the GPS repeater and cable.

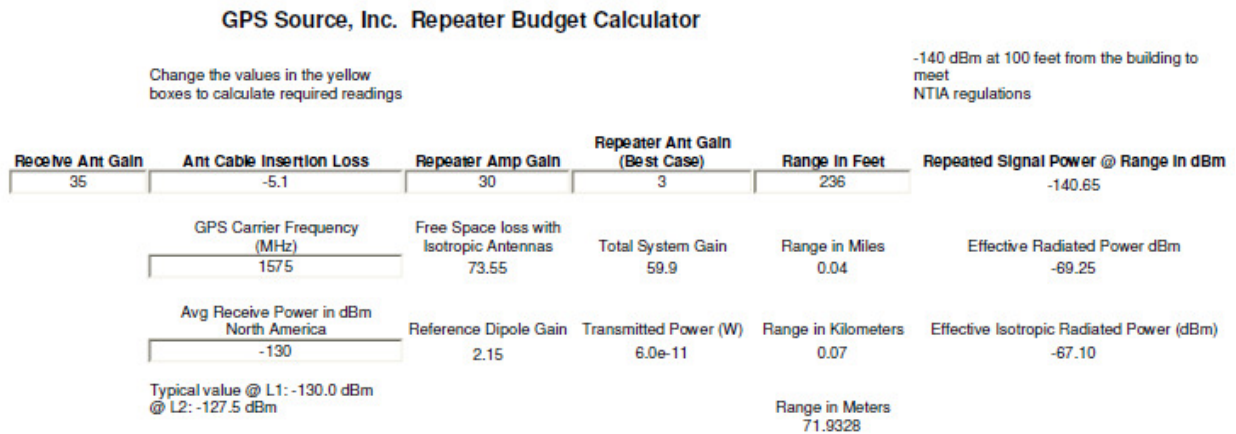


Figure 4. GPS repeated signal level outside Savi Networks building

The signal level 100 feet from the building is -140.65 dBm, which is below the NTIA regulation of -140 dB. In addition, the model of GPS repeater being purchased by Savi Networks includes an adjustable repeater power level. This level can be adjusted down from maximum by as much as 30 dB. All of these calculations have used the maximum repeater power level, while in practice an adjusted signal level intended for operation only inside one corner of the building, may be much lower than -140 dBm.

7. GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.

As documented in 6. above, the area of potential interference to GPS reception is limited to inside the Savi Networks building located at 1292 Anvilwood Ct, Sunnyvale, CA, as well as immediately outside this building but not extending past a distance of 100 feet from the building. This area is under the control of Savi Networks, and Savi Networks has notified our employees regarding the use of the GPS repeater in this facility.

8. The use is limited to activity for the purpose of testing RNSS equipment/systems.

Savi Networks understands and agrees that the use is limited to activity for the purpose of testing RNSS equipment/systems, namely Savi Networks equipment containing a GPS receiver.

9. A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during GPS re-radiation operation of the device under any condition.

Savi Networks provides the following "Stop Buzzer" contact: Bruno Skracic, Savi Networks Tag Logistics Manager, 408 718-3576, STSS-Logistics@savinetworks.com . Savi Networks operates a global business, and is familiar with providing support during any time zone around the world.

Please describe in detail the equipment that will be tested, maintained and operated for which a GPS re radiator is needed.

Savi Networks was formed to improve the efficiency and security of global trade. We supply GPS/GPRS tracking devices to customers for use on their shipping containers. The devices periodically take a GPS location reading, and report this location over the GPRS cellular infrastructure. The devices monitor the security of the container door, and upon detecting any tamper or door opening, take a GPS location reading, and report the time and location of the tamper over the GPRS cellular infrastructure.

One device which will be tested using this GPS repeater is the SN-LSb-01 high security electronic seal. This device contains a u-blox GPS receiver. This device performs as a high security bolt seal to lock the container door hasp, and monitor for any tampers. After sealing the container with the SN-LSb-01, the container door cannot be opened until a bolt cutter is used to cut a bolt locking the device in place. Savi Networks currently has an inventory of 1,000 of these devices and is in the process of manufacturing an additional 10,000 devices, which is why we need an automated self-test, including a GPS receiver check enabled by the GPS indoors repeater. A photo of the SN-LSb-01 is provided here, shown locked to a container door hasp:



Another device which will be tested using this GPS repeater is the EV-LSE-01 location, security and environmental monitoring tag. This device contains a Nemerix GPS receiver. This device monitors opening of the container door, and also monitors the temperature, humidity and shock status of the goods inside the container. Savi Networks currently has an inventory of 5,000 of these devices which is why we need an automated self-test, including a GPS receiver check enabled by the GPS indoors repeater. A photo of the EV-LSE-01 is provided here, shown mounted onto a container door:

