

DESCRIPTION OF PROGRAM OF EXPERIMENTATION

In this application, Trimble Navigation, Ltd. (“Trimble”) requests authority to establish a two-year program of research and experimentation that utilizes six (6) individual devices that re-radiate signals received from the satellites of the Global Positioning System (“GPS”) and augmentations. As Trimble explains below, the proposed devices are to be used as experimental radionavigation-satellite service (“RNSS”) test equipment for the purpose of testing GPS receivers and GPS systems in a commercial environment. Trimble is one of the country’s largest manufacturers of GPS equipment and systems. The use of its six (6) proposed fixed indoor location GPS signal re-radiation devices at its Waltham, Massachusetts, controlled access industrial facility is essential to enable Trimble safely and comprehensively to test the GPS equipment it manufactures and the GPS systems it develops. Trimble has an interest in ensuring that the use of GPS signal re-radiation devices will advance the state of the art in GPS receiver equipment without causing risk to the reliable operation of non-participating GPS equipment already deployed.

Trimble’s demonstration of exceeding the NTIA criteria for authorization of GPS signal re-radiation devices in the context of the instant application follows:

NTIA Criterion No. 1: Individual authorization is necessary for each device at a site-specific location:

Trimble proposes to install the six (6) fixed indoor location experimental (“XT”) GPS signal re-radiation devices for which it presently seeks authorizations in the engineering first floor of a controlled access building located on the premises of its facility in Waltham, Massachusetts. The space where the re-radiators will be located is used exclusively for Trimble operations, including engineering research and development (R&D), design, and test. This space is located on the first floor of a two story building that is under the exclusive control of Trimble. The zone of potential interference from the proposed fixed indoor location GPS re-radiation devices – the fixed transmitting antennas of which will be located indoors – is limited to an immediate area in engineering operations on the first floor within the building in which the device will be located. The locations and descriptions of the devices are as follows:

<u>XT Station Location</u>	<u>User</u>	<u>Latitude</u>	<u>Longitude</u>
1. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W
2. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W
3. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W

4. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W
5. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W
6. 930 Winter St. Suite 2700	Trimble Engineering	42° 24' 17" N	71° 16' 32" W

All transmitting devices are of Trimble's construction according to Attachment 1 of this exhibit.

NTIA Criterion No. 2: Application for frequency assignment should be applied for as an XT station with a note indicating that the device is to be used as an "Experimental RNSS Test Device for the purpose of testing stand-alone GPS receivers or GPS receivers that are an integral component of an equipment under test".

Trimble will limit the use of the fixed indoor location GPS re-radiation devices it proposes here to activities in direct furtherance of its business of developing and manufacturing GPS receivers and systems that use GPS signals and augmentations. The RNSS test devices Trimble proposes in this Experimental Radio Service application are strictly for the purpose of Trimble's testing stand-alone GPS receivers and GPS receivers that are an integral component of equipment or systems under test. This engineering test capability is increasingly important as the basic GPS service is upgraded to include new civilian signals and as additional augmentation systems become available (e.g., EGNOS, GAGAN, QZSS, etc.), these signals and systems are declared experimental until they reach Initial Operational Capability (IOC) and Full Operational Capability (FOC). The GPS system is in a state of dynamic development and change that requires on-going testing and experimentation. Advancing the utility of these new GPS capabilities is important to advancing the art of radio receivers.

NTIA Criterion No. 3: Approved applications for frequency assignment will be entered in the GMF.

The frequency assignment of each of the six (6) proposed fixed indoor location GPS signal re-radiation devices at the three XT station locations in No. 1 above is at the GPS L1-band center frequency of 1575.42 MHz.

NTIA Criterion No. 4: The maximum length of the assignment will be two years, with possible renewal.

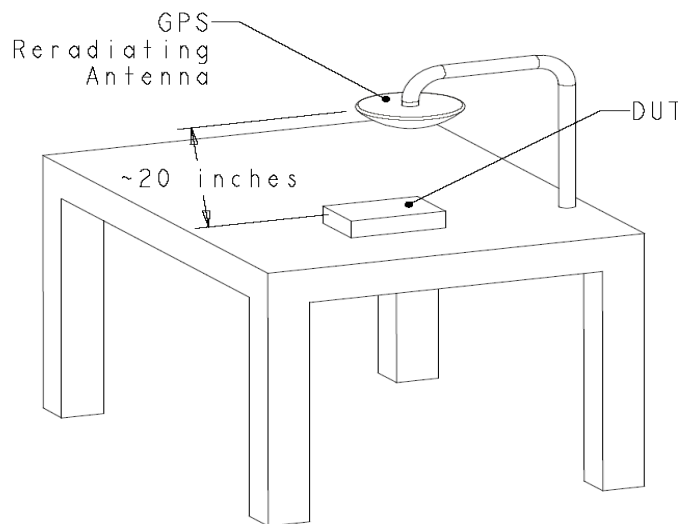
Trimble requests authorizations with a license term of two years, with the possibility of renewal.

NTIA Criterion No. 5: The operation must be at a specified fixed location and mobile operation is not authorized.

The locations of the six (6) GPS signal re-radiation devices proposed by Trimble are fixed at the specific indoor locations identified in No. 1 above.

NTIA Criterion No. 6: The area of potential interference to GPS reception (e.g. military or contractor facility) has to be under the control of the user.

As indicated above, the first floor of a two-story controlled access industrial building in which all six (6) proposed fixed indoor GPS signal re-radiation devices are to be located is used exclusively for Trimble engineering operations, including testing, and the entire building is under the exclusive control of Trimble. The zone of potential interference from the proposed fixed indoor location GPS signal re-radiation devices – and the fixed indoor location transmitting antennas– is limited to a specific immediate area located within engineering operations on the first floor of the controlled access building in which the device will be located. (see No. 7 below). The fixed indoor location each of the six (6) proposed GPS re-radiation devices will be suspended approximately 20 inches above the desk of an engineer within a cubicle that is located at a minimum distance of 8 feet from the exterior wall of the controlled access building. All doors to this facility remain closed as required by controlled access. The Trimble engineer who occupies the cubicle in which a re-radiation device is installed maintains operational control of the device. The cubicle test area is depicted in the diagram below. “DUT” stands for Device Under Test.



NTIA Criterion No. 7: The maximum equivalent isotropically radiated power must be such that the calculated emissions are no greater than -140 dBm/24 MHz 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 building attenuation.

The maximum equivalent isotropically radiated power (“EIRP”) from the proposed re-radiation device is such that the calculated emissions are more restrictive than -140 dBm/24 MHz at a distance of 30 meters established in Section 8.3.28 of the NTIA Manual and thus more than meets the NTIA values. Trimble’s GPS re-radiation devices will operate at power levels of -97 dBm/24MHz EIRP in the L-1 GPS band, which results in less than -140 dBm/24 MHz at a

distance of 8 feet from the radiating antenna. **Attachment 2 to Exhibit 1 includes Trimble's calculations showing how this determination was made. Trimble notes that the determination was based on free space propagation, and did not include any allowance for building attenuation.**

NTIA Criterion No. 8: GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.

Trimble will post signs in the specific immediate zone [within the building] where there is potential of interference from the GPS re-radiation devices proposed here to GPS reception. GPS users external to this facility will not be affected since the zone of potential interference is located within the facility.

NTIA Criterion No. 9: The use is limited to activity for the purpose of testing RNSS equipment/systems.

Trimble will strictly limit the use of the GPS re-radiation devices proposed here to activities in direct furtherance of its business of developing and manufacturing GPS receivers and systems that use GPS equipment.

This test program is increasingly important due to the advent of new civilian signal (L2C) and new augmentation systems (e.g., EGNOS, GAGAN, etc.) which will have experimental status for several years.

NTIA Criterion No. 10: 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.

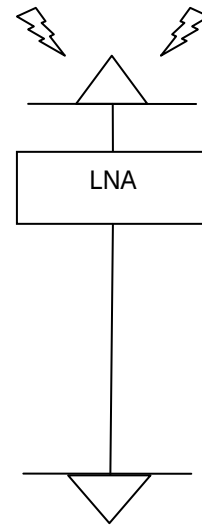
Each re-radiation device is used by, and under the control of, a single engineer in whose cubicle the device is installed. Point of Contact: Peter Bronk at fcclicenseliason@trimble.com Peter Bronk daytime phone: 781-434-6709 (after hours: John Surovy, Office Manager, mobile phone: 617-513-7805).

ATTACHMENT 1 TO EXHIBIT 1

Trimble re-radiation network

The proposed re-radiators consist of a rooftop antenna and low-noise amplifier (LNA) that receive existing GPS signals, followed by a distribution system (which consists of cables, splitters and amplifiers) and a passive re-radiating antenna. The re-radiating antenna is pointed downward approximately a foot above a desk in an engineering cubicle. The system gain of a re-radiator is shown in the diagram below.

	<u>L1</u>
Received power	-128.5dBm
LNA Gain	+38db
Distribution network, minimum loss	-6.5db
Antenna 1.5m above ground, pointed down, <0dBi horizontal antenna gain	0db
Net radiated power (sum of columns)	-97dBm



ATTACHMENT 2 TO EXHIBIT 1

Compliance with NTIA EIRP limit

Path loss is calculated from the standard equation below

$$P_d = P_r - 20 \log\left(\frac{d * 4\pi}{\lambda}\right)$$

Where P_d is the power of the signal at distance d , and λ is the wavelength of signal.

For our calculations, P_r is net power radiated from Attachment 1 (-97dBm for L1); while λ is 0.1904 meters for L1. Using these figures, we find the following for P_d :

Calculation of power level at 2.5 meters

Band	L1
Radiated power	-97dBm
Path loss at 2.5 meters	-44.3db
Power level at 2.5 meters	-141.3dBm

Calculation of power level at 30 meters

Band	L1
Radiated power	-97dBm
Path loss at 30 meters	-65.9db
Power level at 30 meters	-162.9dBm

From this it can be seen that the proposed re-radiation network meets the NTIA standard of -140dBm at 100 feet, with over 20db of margin to protect the external use of GPS. This calculation is made based on free space propagation. No allowance is made for the walls of the building. If the walls of the building were not present, radiation would be at or below -140dBm where the walls presently stand. Furthermore, the radiation beyond the limits of the facility (building plus parking lot) will always be below -160dBm, again without accounting for building walls.