Exhibits to Experimental License FCC Form 442
Application File No. 0182-EX-PL-2010

Exhibit A

Background: Greenwood Telecommunications Consultants LLC, Denver Colorado, is a technical and market research firm to the wireless telecommunications industry, founded in 1997. Greenwood has a client relationship with Insiteo SA, a French company developing in-building GPS technology and network systems. Greenwood has been hired to act as a test and demonstration plan organizer for the Insiteo technology for the US and to conduct tests inside representative venues to assess the commercial and public safety values of such a system. These tests will become part of the license record. It is well known to the Commission that mobile GPS is inadequate for precise (Phase II) indoor location. In partnership with public safety agencies and interest groups, the Commission has on-going inquiries and plans rulemaking later this year to address difference aspects of locating consumers inside buildings where they work, commute, and live. It is the intent of the Greenwood/Insiteo relationship to demonstrate to FCC and other appropriate groups and agencies the validity of this solution for extending the reach of common GPS handsets to work inside buildings deployed with Insiteo networks.

Research Project Objectives

I. The research objectives are:
    a. Demonstrate the limits of indoor location solutions designed to provide mobile subscribers already equipped with built-in GPS receivers to continue operating when inside major public venues or buildings, where a sufficient number of GPS satellite signals are too weak to detect and produce a position fix.
    b. Assess and demonstrate an advanced network design method which has specific features to avoid interfering with normal operation to all nearby GPS receivers, even those receivers that come close to the indoor covered venues (to a high degree these will almost always be inside core urban buildings, train and underground stations where there is a substantial number of pedestrians).
    c. Demonstrate the continuous monitor function to monitor interior venue, interior signals that leak outside, and the normal outdoor satellite signal levels so as to maintain highest margins of interference immunity to any GPS receiver in the vicinity.
    d. Obtain data to practically assist GPS mobile devices already equipped to receive both outdoor and in-building GPS signals when working near the venue and able to exploit network offered reception assistance.
    e. Demonstrate the public safety benefits of this solution for high traffic volume venues

f. Assess the practical limits, predictability or stability of the interior signal calibration process, and controls needed to deploy following commercial installation practices used for convention communication, security systems deployed in the same facilities
g. Demonstrate the hot-switch safety mechanism
h. If time permits, assess usefulness of other global satellite signal methods either in test or deployed elsewhere that also use in-building emitters, or pseudolites (e.g., Japan IMES, Europe CEPT draft standard, Galileo E6 signals) and could offer US- or internationally based suppliers an international market to pursue in order to realize economies of scale.
i. Assess technical feasibility including limitations and practicality of alternative non-GPS signals (e.g., WiFi 802.11) to supply similar indoor positioning solutions that could work without hardware modification to existing commercially available consumer cell-phone handsets.

II. The nature of the research design involves deployment, calibrating, and measuring the signals indoors, and that are public venues chosen mainly for the volume of public traffic "walk-throughs". The selections also are based on venues that may have somewhat unique geographical characteristics where there is practical value for personal navigation, and alerting people based on their immediate, precise indoor location. Among the candidate locations are trade show convention centers, metro rail and train stations, airports, and major museums.

For more details, we encourage the FCC to view a short web video and demonstration of an early prototype system which is the subject of this research. This version presently operates continuously in a Paris, France convention center. http://www.gpsbusinessnews.com/Insiteo-indoor-positioning-We-Target-2M-Revenue-in-2010_a2005.html

Necessity of Using the GPS L1 Band for This Research

Existing mobile devices with GPS receivers process 8-11 available satellite navigation signals at once. In order for this to work everywhere, the GPS signal structure is designed for the GPS receiver to tolerate a high degree of same-system, on-channel interference to measure the different signal timings resulting from each satellite to mobile path then process this using geometry to an exact geographic position on the Earth. The GPS L1 signal is "built", that is the GPS receiver and signal structure is designed to tolerate between 21-24 dB power level differences among the signals enabling recovery of the weaker GPS signals in the present of one or more strong GPS signals. This generates the largest possible number of independent on-channel signals and leads to the highest position accuracy.

The existing L1 signal, if properly managed, can also be emitted from inside buildings without emitting so much signal power that would otherwise exceed the GPS receiver interference margin. The research network and system design envisions continuous surveillance of all emitter signals from a point outside the venue in order to regulate the indoor emitter levels accordingly thus protect on-channel interference margins.

The same monitoring receiver also provides valuable information on the local status of GPS signals which are useful for research and potentially for commercial and public safety which all rely in various ways on GPS.

This and the other research objectives cannot be accomplished without using and emitting compatible on-channel L1 signals from inside the building. The research network automatic regulation contemplates staying within the acceptable current emission limit as prescribed under NTIA Rule 8.28.3 when measured with an isotropic antenna 30 meters away from the closest point of the venue building.

Inadequate Alternative, Existing Communications Facilities

Other signals are theoretically available for locating common consumer mobile devices, but the alternatives have deficiencies as shown in the table below.

Alternative Positioning Signals	Suitable factors	Non-suitable factors
WiFi, 2.4 Ghz 802.11 b,g, n, Bluetooth	Commercial, no administration licensing factors, low cost general communications solutions	Crowded band, not suited for accurate positioning without many devices, not suited for time-weighted measurements, battery drain issues, tracking issues.
WiFi, 5.8 GHz, 802.11a	Commercial, no administration licensing factors, relatively unused today	Could become crowded spectrum inside building in the near future, not in mobile devices today or likely near term to be prevalent in mobile.
WiMax	Signal structure	Not designed to uniformly available indoor. At most one proximate base station likely indoor, thus not suitable for trilateral, precision based position fix measurements

Novelty of Approach; Importance of Tests

It is this company's best belief and understanding that this in-building GPS navigation network solution is novel. Therefore, we believe it deserves comprehensive and careful testing in representative live environments and using appropriate and built-in safeguards to ensure no interference risk to existing GPS receiver performance. This solution is powerful in that it does not require hardware modification to consumer mobile handsets in order to navigate indoor in the same fashion as these devices perform outdoor.

A feature of the network is to provide continuous monitoring and control of indoor GPS signal power levels, typically located near an outdoor exit to the building. The commercial system provides software planning tool to adjust the number and placement sites within the room volumes to achieve accuracy levels while also ensuring minimal outside signal leakage to avoid signal interference immediately outside the building. The level of network intelligence and management, combined with use of directional antennae is unique. This will be the first time to our knowledge that such an in-building on-L1 channel system intended to work with common mobile GPS phones has been tried.

Finally, this particular system has not been proposed elsewhere eventhough it has certain similarities to other in-building solutions emitting on the L1 frequency. These systems are today being tested in other countries (such as GNSS Technologies, Tokyo Japan, and its QZSS IMES pseudolite network system). To our knowledge, no similar mobile GPS augmentation system has applied for a license to test in this country. Even if there were alternatives in test, a reasonable number of diverse alternatives should be tested to understand the spectrum co-existence and signal power management issues acutely. This system based on reasonable belief is unique and thus could contribute greater understanding to US regulatory agencies and public safety, the military, and the GPS industry at large.

While operating standards are in draft in European and Japan standards, we believe the US is not as far advanced as these regions and should encourage a similar degree of progress to enable US based businesses to install and offer similar solutions. This research will contribute to radio technology and GPS art from the US perspective for indoor location and E911 applications.

Program of Research and Experimentation Proposed

The objectives of the research are provided above. This program envisions tests in a large convention center, the Moscone Center in San Francisco, which is close to a participation arrangement with a major West Coast university involved in GPS research, which this company and its GPS indoor network supplier are close to developing a final test plan.

For purposes of this disclosure, we plan to use the first nine (9) months to generate tests related to the objectives outlined that will be done in conjunction with PhD level academic study of GPS inbuidling signals, and use university students to set up and conduct tests with oversight from Greenwood and Insiteo. These companies are currently working with one multi-national GPS chipset company to modify its receiver to accept ground based signals in addition to satellite signals.

Another purpose of this research is to demonstrate the practical factors for broader commercial adoption, and in so doing, show this innovation has public safety value as well since it extends mobile position coverage deep inside major buildings. Therefore, in the second nine (9) months the plan is to perform on-going demonstrations to public safety and law enforcement officials who are known to be seeking augmentation solutions. Another purpose is to demonstrate the live system to application and silicon partners and development companies which have interest in further exploiting user-friendly methods of mobile search positions or references for up to the second information, maps, offers relevant to the venue. We believe we can incite US based enterprises to deploy, build applications using this innovative network system if this network meets its commercial and technical claims.

Another purpose of this research is to demonstrate the system’s ability to maintain practical interference margins under live test conditions and be scrutinized by knowledgeable academic and government and GPS industry representatives.

Another purpose of this research is to provide ample engineering data if the system operates as planned to provide spectrum and other operational safeguards sufficient to license use commercially as a non-interfering and/or augmenting method to co-exist with proximate GPS receivers.

EXHIBIT B

Research and Testing Infrastructure

The infrastructure is composed of:

- A signal generator. This equipment has the capability to generate six synchronous L1 (1575.42 MHz) GPS signals, with adjustable power levels to ensure a full compliance with authorized levels. This equipment is typically placed in a dedicated room, is secure.
- A remote server that controls the signal generator and ensures the dialog with the end user smartphone. The server is a standard product.
- A set of antennas placed typically in the corners of the building.
- Optical fibers that carry transmission signals and connect the signal generator to each L1 signal antenna. The fibers are connected to the signal generator and to the antennas via commercially available RF/optic converters.
- A outside monitoring receiver that continuously monitors indoor and outside GPS L1 signals, in order to ensure power levels do not exceed the maximum authorized level.

Highlights of key RF products

Signal generator

The indoor network L1 based signal generator is manufactured by Silicom (www.silicom.fr), a company specialized in GPS simulators, and is similar to commercially available GPS signal simulators used across the world in R&D, manufacturing and testing locations.

Below a picture of the rack mounted unit, the TA 1000:

The Silicom TA 1000 product is approximately 30cm x 20cm x 4 cm and weights 0,9 kg.

L1 Band Indoor Antenna

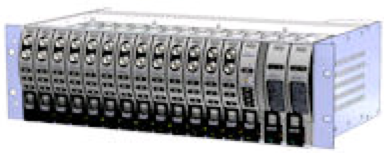
The test antennas are helical models and are manufactured by AUCON (www.aucon.de). Below a picture of the test product and a picture in separated parts:

The major antenna characteristics are:

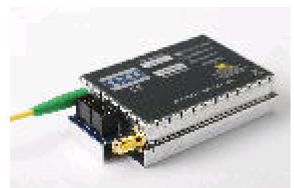
- Polarization : RHCP
- Size: 80 x 80 x 90 mm
- Mounted: Mounted on the ceiling, have controlled aim and orientation to achieve interference, coverage, accuracy objectives.

Optical to RF L1 Signal Converters

The system uses optical to RF converters to distribute signals, and distribute from a rack-mounted box.



This element is commercially available from Vialite (http://www.vialite.co.uk). These devices are commonly used for providing GPS signals into tunnels, providing remote GPS signals for military and commercial applications



The characteristics of the transmitters (attached by jacketed optical strands to the signal generator) are:

- LRT-L1-6M-03-S1310
- L Band Transmitter 1310nm DFB, 950-2150MHz
- 50 ohm SMA Electrical, FC/APC Optical
- -11dB Module Gain, OEM Module
- Ext LNA Feed

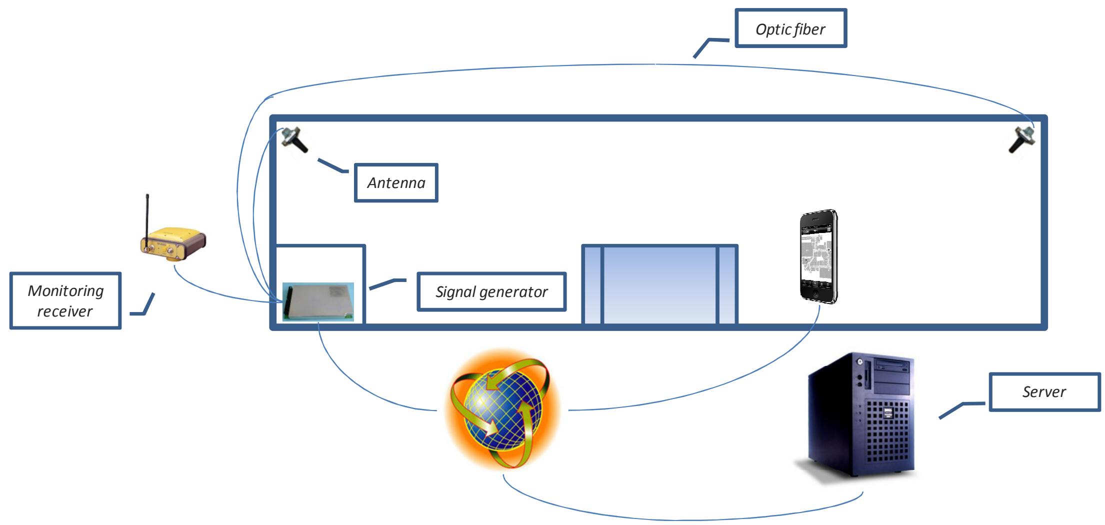
The characteristics of the receiver (attached to the antenna) are:

- LRR-L1-6R-04
- L Band Receiver, 950-2150 MHz
- 50 ohm SMA Electrical, FC/APC Optical
- 20dB Module Gain - variable +/- 3dB
- Plug-In module

Site Schematic Diagram and Implementation

The following schematic graphic illustrates the physical layout and implementation of the network solution inside the live test building.

Up to 25 antennas may be used as well as testing a variety of emitter locations to achieve appropriate understanding of interference, inside coverage and accuracy.



Note: The server and signal generator have both local and remote "hot switches" that can instantly shut down the network L1 emitters if necessary. The monitoring receiver is mounted outdoor at a position to detect in and outdoor GPS signals and is calibrated to correspond to indoor signal levels surrounding the perimeter of the building.

Compatibility Analysis with Other Receivers and Experimentally Licensed Network

Introduction

Pseudolites (Pseudo Satellites) are ground based radio transmitters that transmit an RNSS-like navigation signal. Most of user receivers commercially available today can take advantage of such signals via a simple software modification, making possible to extend the satellite navigation technology to difficult to reach environments like inside structures.

It is proposed to develop an indoor positioning system based on a similar emitter network founded on pseudolite design principles that 1) transmits on Global Positioning System (GPS) L1 carrier frequency at 1575.42 MHz (+/- 12 MHz).

Initial deployment started in Paris, France for certain demonstration and test purposes in January 2010. Greenwood Telecommunications believe tests in other environments in the US that are available for academic, industry installation and commercial analysis are important to advice industry, military and academic interests on the utility, feasibility and L1 GPS interference potential at representative building sites.

Network System Description

It is intended to transmit signals identical to the existing GPS L1 band C/A-code signals, occupying the same channel bandwidth. To prevent interference with non-participating GPS receivers, these pseudolites:

- will be deployed indoors, in areas where GPS satellite signals are not otherwise visible;
- will transmit at low power levels, and are analyzed below in Exhibit C;
- will each use a unique CDMA PRN that are code-orthogonal (thus least interfering) to those of any GPS satellites visible to non-participating GPS receivers in the surroundings.

Key Differences between GPS Repeaters and Pseudolites

GPS repeaters receive, amplify and re-broadcast signals from existing GPS satellites without changing those signals in any way other than increasing their power. The applicable NTIA Rule requires that such re-radiating systems not result in signal levels rising above -140dBm outside a 100ft (~30m) perimeter.

The European standards body, CEPT, has reviewed the impact of GPS repeaters on non-participating receivers in ECC Report 129 (a copy of this report can be provided interested parties). This report concludes that signals from GPS repeaters should be limited such that signals reach non-participating receivers at a level at least 10dB below that of signals received from GPS satellites and proposes limiting the repeater maximum output gain to -20dBm.

This network uses in principle a new generation of pseudolites, that are designed to complement existing GPS satellite signals. They expand the set of available signals using identical properties to the satellite signals, but to distinguish each signal, all are assigned a unique PRN code that unless is programmed into a receiver is effectively discarded by non-participating GPS receivers.

Non-participating GPS receivers are unaware of pseudolite PRNs thus cannot acquire or track them. Using this network the pseudolite signals at most appear as a negligible amount of wideband noise to non-participating GPS receivers. The objective is to limit this noise to an extent that weaker satellite borne GPS signals are not blocked. Studies shall be undertaken to determine the thresholds below which non-participating receivers are unaffected are considered in the following section.

EXHIBIT C

Analysis of Experimental Network Impact on Non-Participating GPS Receivers

Studies conducted and reviewed by CEPT and published in ECC Report 128 have concluded that pseudolite systems operating in the manner proposed by Greenwood Telecommunications and its experimental network vendor, Insiteo SA, should pose no threat to non-participating radio users outside the L1 band and for network emitters transmission at the prescribed EIRP level of -59dBm, this at most requires a protection radius of much less than 10m.

It is suggested that, since GPS pseudolites are fundamentally less interfering than repeaters and pose a significantly lower threat to non-participating receivers, the maximum power levels and minimum separation distances for GPS pseudolites should be set to the same limits as set for GPS L1 repeaters.

In the analysis below, which is based on the CEPT Minimum Coupling Loss (MCL) calculations, it is demonstrated that the proposal to deploy pseudolite inside buildings be at an EIRP power level up to -50dBm, at which level it is shown below that the in-building emitters do not adversely affect non-participating GPS receiver acquisition or tracking when these receivers operate anywhere outside a 30 meter perimeter, whether the loss of ordinary building attenuation is taken into account or not.

Table 1 below shows the calculation of signal level received by non-participating receivers at a distance of 30m from the exterior walls of the sites of the proposed pseudolite system.

Parameter	**Equation**	**Value**	**Unit**
Pseudolite power (EIRP)	Tx power + antenna gain	-50	dBm
Building loss (L_B) @ 1575.42 MHz	CEPT building analysis (optional loss factor)	8	dB
Path loss over 30m @ 1575.42 MHz (L_P)	20*log ($4\pi d/\lambda$)	65.9	dB
Received power @ 30m (using an isotropic receiver antenna, as prescribed by the NTIA Rule for GPS repeater power measurements)	EIRP - L_B - L_P	-123.9 -115.9 ignoring building loss	dBm

TABLE 1: MAXIMUM POWER LEVEL AT 30 METER BUILDING PERIMETER (NTIA CRITERION)

In conducting its analysis of the effects of pseudolite transmissions on non-participating receivers, CEPT considered five classes of receivers as defined by the ITU. The general characteristics of those systems as well as the maximum thresholds of wideband interference generated by pseudolites operating in the same band are summarized in Table 2 below.

	Non-Participating Receiver (by ITU Category)				
	A-RNSS	General Purpose 1	General Purpose 2	Indoor Positioning	High Precision
Signal frequency range	1575.42 ±12 MHz	1575.42 ±12 MHz	1561.098 ±2.046 MHz 1589.742 ±2.046 MHz	1575.42 ±12 MHz	1575.42 ±12 MHz
RF filter 3dB bandwidth (MHz)	30.69	±16	5	±16	30.69
Tracking mode threshold power density level of aggregate wideband interference at passive antenna output (dB(W/MHz))	-146.9	-136	-140	-142	-147.4
Tracking mode wideband interference threshold power level in pseudolite bandwidth (dBm)	-113.89	-102.99	-106.99	-108.99	-114.39
Acquisition mode threshold power density level of aggregate wideband interference at the passive antenna output (dB(W/MHz)	-146.9	-142	-146	-148	-147.4
Acquisition mode wideband interference threshold power level in pseudolite bandwidth (dBm)	-113.89	-108.99	-112.99	-114.99	-114.39

TABLE 2: ITU WIDEBAND INTERFERENCE THRESHOLDS OF NON-PARTICIPATING RECEIVERS OPERATING IN THE L1 BAND

Based on this analysis, CEPT concluded that a minimum protection distance of < 4m would be required to ensure non-interference of a pseudolite system emitting an EIRP of -59dBm in the L1 band. Figure 1 below illustrates the power received by such a pseudolite as a function of distance and wideband interference thresholds of each non-participating receiver system in acquisition mode.

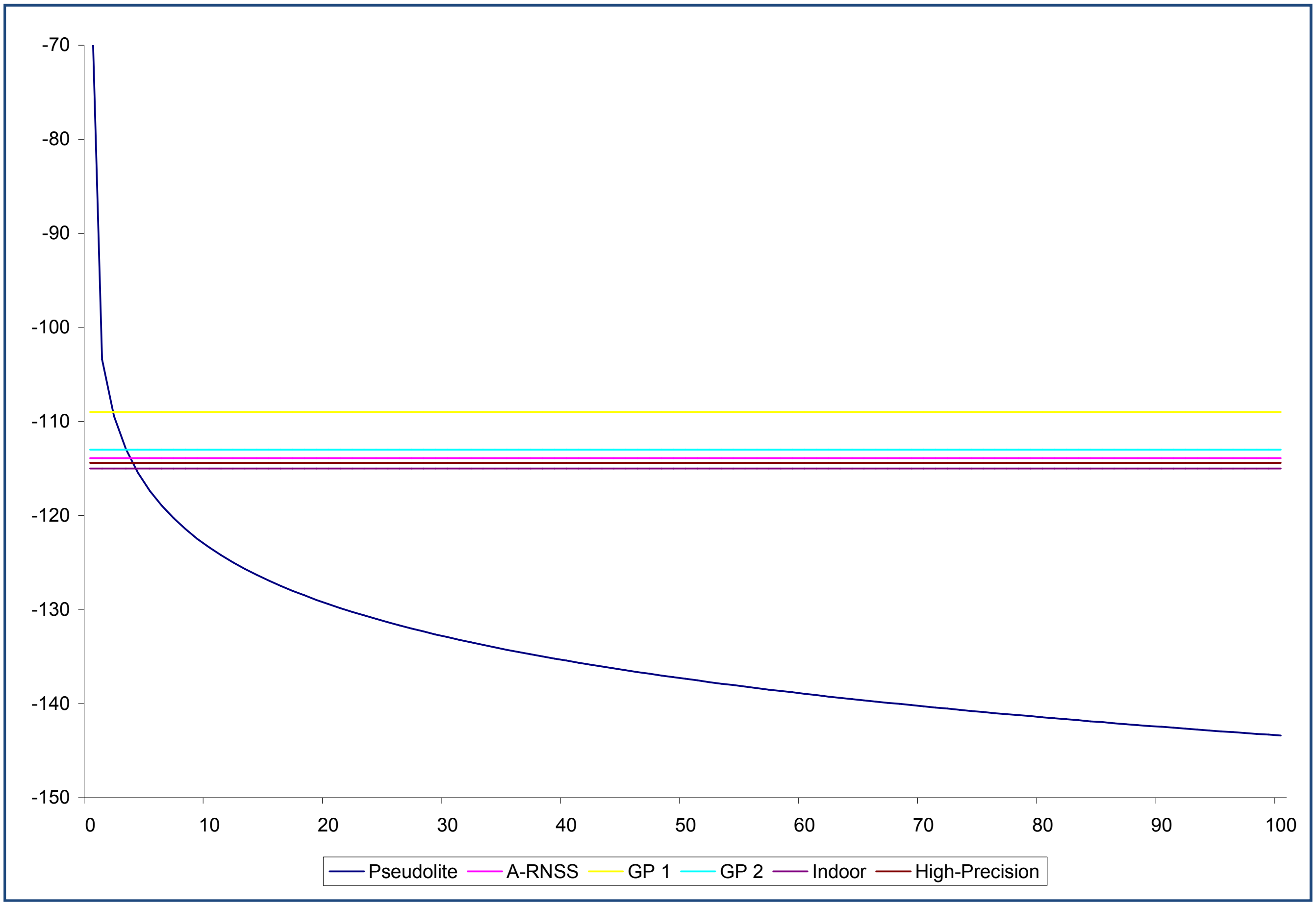


FIGURE 1: PSEUDOLITE POWER OVER DISTANCE V. INTERFERENCE THRESHOLDS OF NON-PARTICIPATING RECEIVERS (CURVED LINE REPRESENTS PSEUDOLITE POWER PROFILE AT VARIOUS DISTANCES)

In order to determine what guidelines for GPS pseudolites would be consistent with those already governing GPS repeaters, Insiteo has performed a similar analysis to determine (a) the minimum separation distance required to protect non-participating receivers from pseudolites transmitting at an EIRP of -50dBm and (b) the maximum pseudolite EIRP which would guarantee a minimum protection distance of 30m (100ft). The results of this analysis are summarized in Table 3 below.

	Non-Participating Receiver System				
	A-RNSS	General Purpose 1	General Purpose 2	Indoor	High-Precision
Minimum protection distance in acquisition mode from pseudolite with EIRP of -50dBm (m)	9.43	5.37	8.51	10.71	9.99
Maximum pseudolite EIRP to guarantee minimum protection distance in acquisition mode of 30m (dBm)	-40	-36	-40	-42	-41

TABLE 3: MINIMUM PROTECTION DISTANCE AND MAXIMUM EIRP TO ENSURE NON-INTERFERENCE OF PSEUDOLITES WITH NON-PARTICIPATING RECEIVERS (ITU RECEIVER CLASSES)

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