

# OfW 524 Guidance on the licensing of GNSS repeaters

## Introduction

- 1.1 Global Navigation Satellite System (GNSS) repeaters receive, amplify and transmit GNSS signals in order to provide coverage within a building where the GNSS signals would not otherwise reach. A GNSS repeater consists of:
  - 1.1.1 an external antenna, often mounted on the outside of a building, for the reception of GNSS signals;
  - 1.1.2 a pre-amplifier (and sometimes a band pass filter); and
  - 1.1.3 a second antenna, which re-transmits the GPS signal to receivers inside the building<sup>1</sup>
- 1.2 On 20 June 2012, Ofcom published its Statement on the Authorisation Regime for GNSS Repeaters<sup>2</sup> (the Statement) in which it decided to implement a light licence approach for GNSS repeaters.
- 1.3 This information leaflet provides some general guidance for GNSS repeater licence applications and installations.
- 1.4 It should be noted that the Statement relates only to GNSS repeater systems and does not apply to other technologies, such as GSM, UMTS, WiMAX and LTE, where the use of repeater equipment (other than by the licensed network operators) is a criminal offence under the Wireless Telegraphy Act 2006 (the Act).

## Legislation

- 1.5 Under the Act, the use of any radio equipment without a licence (unless specifically exempted from licensing) is unlawful.
- 1.6 Operating without a licence, or failing to comply with the terms of your licence, increases the risk of harmful interference and can threaten the safety of human life. Consequently, there are penalties for unlicensed or incorrect use, which can include a fine, imprisonment and forfeiture of any equipment associated with the offence.
- 1.7 As a licensee, you are ultimately responsible for the actions of anyone who uses the equipment covered by your licence. You should therefore study the conditions attached to the licence, and ensure that anyone using your radio equipment is familiar with them.

## Licence conditions

- 1.8 Amongst other things, the licence includes the following obligations:

---

<sup>1</sup>Note that the position reported by a GNSS receiver that is using a signal from GNSS repeater antenna will be that of the GNSS repeater's receive antenna on the outside of the building, not the true location of the GNSS receiver.

<sup>2</sup> <http://stakeholders.ofcom.org.uk/binaries/consultations/950601/statement/statement.pdf>

- a) That the GNSS repeater may only transmit indoors, and towards GNSS receivers inside the same building;
  - b) That the GNSS repeater must meet the technical conditions in UK Interface Requirement 2089<sup>3</sup>, including the limit on the overall gain of the GNSS repeater.
- 1.9 The licence also specifies the site address for the GNSS repeater, and its location to 10 metres accuracy. If a licensee wishes to place a GNSS repeater as a different location, it would need to apply for a separate licence or request that Ofcom vary its existing licence.

## Installation Guidance

- 1.10 As a GNSS repeater uses the spectrum of the main GNSS satellite signal, it is important that as far as possible the licensee uses the equipment in a way that minimises the risk of interference to other GNSS users. As a result, the following information provides guidance as to ways in which the risk of such interference may be minimised. However the information is provided by way of guidance only, and is independent from any obligations imposed under the GNSS repeater licence.
- 1.11 The GNSS repeater transmit antenna should be located as close as possible to the area where the desired GNSS receiver needs to receive a signal. This is so that the antenna can operate at the minimum level necessary to perform the intended function.
- 1.12 The GNSS repeater receive antenna should be located outside and with a good visibility of the sky. To reduce cable losses, it should be located as close as possible to the area where the inside re-radiator will be installed. However, the GNSS repeater transmit and receive antennas must be placed far enough apart (and have enough radio frequency (RF) propagation attenuation between them) to ensure that the GNSS repeater does not go into a self-oscillation mode.
- 1.13 GNSS repeater installations should use low loss cable. Users can only compensate up to 3dB cable losses, by increasing the GNSS repeater gain from 45-48dB (according to the ETSI EN 302 645 standard). Any cable losses above 3 dB will reduce the effective area of the GNSS repeater.
- 1.14 Typical residential and high rise office construction of brick and concrete walls provide some RF attenuation of the GNSS repeater signal towards the outside<sup>4</sup>, but glass and windows have much less RF attenuation. Therefore, the GNSS repeater's transmit antenna should be placed away from (and with the main gain of the antenna directed away from) windows or doors.
- 1.15 To avoid interference with outside GNSS receivers, the licensee may consider the provision of additional RF attenuation or shielding for directions away from the area required for the re-radiated GNSS signals, i.e. reducing the gain or moving the antenna further indoors.

---

<sup>3</sup> IR2089 [LINK](#)

<sup>4</sup> Based on the results of building measurements devices operating in frequencies near to the GNSS bands and operating indoors show an average building attenuation of 9 dB.

- 1.16 A licence under the Act is not an automatic approval for the installation of a GNSS repeater in a building or place. Site owners might impose particular site limitations through operation of their landlord rights, and may require prior approval of such an installation. Ofcom will not be aware of such limitations and the application for and grant of any GNSS repeater licence is separate from any installation approval needed by the licence applicant. Ofcom therefore urges licence applicants to seek any relevant landlord permissions from the owners or operators of relevant buildings or places. Applicants should note that Ofcom does not require copies of landlord approvals before issuing a licence, as we have placed no pre-coordination requirements on the licence.

### Application guidance - National Grid References

- 1.17 The licence application requires the prospective licence to provide the position of the proposed GNSS repeater to 10 metres accuracy.
- 1.18 An explanation of how to derive a National Grid Reference (NGR) for a specific location can be found on the Ordnance Survey website.<sup>5</sup> However, this Ordnance Survey guidance relates to NGR locations to 100 metre accuracy. There are online services that can provide this information to 10 metres accuracy.
- 1.19 An NGR to 10 metres accuracy has two letters and four digits for the easting and four digits for the northing, as shown below:

<b>2 Letters; 4-figure Easting; 4-figure Northing</b>	<b>T</b>	<b>Q</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>0</b>
-------------------------------------------------------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

- 1.20 Some websites may give a Grid Reference to 1 metre accuracy such as:  
“SK 23658 58194” (two letters and five figures)
- 1.21 If you have an NGR reference to 1 metre accuracy, please provide it in the form “SK 2366 5819”, by removing the last digit (if this number is greater than 5 raise the fourth digit by one, if it is less than 5 leave do not raise the fourth digit).

---

<sup>5</sup> <http://www.ordnancesurvey.co.uk/oswebsite/gi/nationalgrid/nghelp1.html>