



Eskom

Standard

Technology

Title: **DUAL FREQUENCY GLOBAL NAVIGATION SATELLITE SYSTEM RECEIVER STANDARD**

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1. Introduction

The Global Navigation Satellite System (GNSS) is a 3 dimensional (3D) positioning system that makes use of the orbiting satellites for position determination. These satellites generate and transmit timing signals and ephemeris data that are used to determine the position of a satellite at the moment of transmission. These signals are received and decoded by a GNSS receiver to determine the 3D position of the receiver.

The signals that are sent lie within the microwave range of the electromagnetic spectrum and are subject to a variety of atmospheric affects that create variances in the signals. On top of this is the additional possible effect of selective availability which was until recently added to the signals to degrade their accuracy. The result of these effects is a decrease in the accuracy of the position calculated. To improve the accuracies that can be obtained by the system a process known as Differential Global Navigation Satellite System (DGNS) is used. DGNS operates by employing at least 2 receivers, a rover and a base, operating at the same time. The base receiver is set up at a known point and the rover receiver is used to fix new points. In this way the corrections that are to be applied can be calculated from the base and hence to the rover. The accuracy of this method in terms of position obtained will be proportional to the distance between the base station and rover receiver.

A geodetic GNSS receiver is a tool used to determine position location with centimetre accuracy using DGNS.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

This standard sets out Eskom's requirements for Dual Frequency Geodetic Global Positioning System Receivers.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] Land Survey Act 8 of 1997

[2] Regulations Promulgated In Terms Of Section 10 Of The Land Survey Act, 1997 (Act No. 8 of 1997)

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

None

2.3.2 Disclosure classification

Controlled Disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

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2.4 Abbreviations

Abbreviation	Description
BeiDou	BeiDou Navigation Satellite System is China's version of the USA GPS system
CAD	Computer aided design
DGNSS	Differential global navigation satellite system
DTM	Digital terrain model
Galileo	Galileo is the European version of the USA GPS system
GIS	Geographic information system
GLONASS	Globalnaya Navigazionnaya Sputnikovaya Sistema. GLONASS is Russia's version of USA GPS (Global Positioning System)
GPS	USA global positioning system
L1 C/A	Course/acquisition code transmitted on L1 satellite signal
L2C	Civilian code transmitted on L2 satellite signal
L5	A civilian "safety of life" signal
OTF	On the fly
RTK	real time kinematic

2.5 Roles and Responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/Supporting Documents

Not applicable.

3. Dual Frequency Geodetic Global navigation satellite System Receivers standard

3.1 Detail specifications

3.1.1 Receiver

The receiver shall be capable of simultaneously receiving and recording on at least 36 channels:

- a) GPS L1 C/A Code, L2C, L1/L2/L5 full cycle carrier
- b) GLONASS L1 C/A Code, L1 P Code, L2 P Code, L1/L2 full cycle carrier
- c) Galileo: E1, E5a, E5B
- d) BeiDou: B1, B2

The receiver shall be capable of simultaneously receiving and recording data as specified in 3.1.1a and b, from at least nine (9) satellites.

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The receiver epoch interval shall be able to be set to any integer number of seconds being in the range one (1) to sixty (60) seconds.

The receiver and ancillary equipment shall cater for the different types of carrier phase differential GNSS measurements relating to:

- a) Static surveys
- b) Kinematic surveys
- c) Real-time kinematic with on-the-fly capability (RTK/OTF)

3.1.2 Antenna

- a) The antenna for each receiver shall be capable of receiving all data specified in paragraph 3.1.1
- b) The antenna shall be of a design sufficient to adequately reduce the effect of multipathing

3.1.3 Radio communication

- a) Radio modems to fulfill RTK/OTF capability shall be supplied
- b) Radio modem frequencies shall comply with standards and specifications laid down by the Department of Posts and Telecommunications.
- c) An option shall exist for the receiving of satellite delivered corrections

3.1.4 Datalogging and retrieval

- a) The receiver shall have an internal memory capable of storing at least 100 000 epochs of L1/L2/L2C/L5/GLONASS/BeiDou/Galileo satellite data. The vendor shall state the memory capacity in both Megabytes and hours of data from five (5) satellites at one (1) second epochs.
- b) Data download capability (direct cable or wireless) shall be provided to transfer logged data from the receiver directly to a personal computer.
- c) The vendor shall state the minimum hardware requirements required for downloading of data onto a personal computer.

3.1.5 Power supply

- a) The receiver, antenna and ancillary equipment shall be capable of operating on internal and/or external battery supplies at between d.c.10V and d.c. 35V.
- b) The maximum power consumption of the fully operational receiver, antenna and other equipment shall not exceed 10 W.
- c) The battery capacity provided shall be capable of keeping the receiver, antenna and other equipment fully operational for at least 8 h.
- d) Standby battery capacity equivalent to that supplied in paragraph c) shall be supplied with each receiver.
- e) Sufficient battery charging facilities shall be provided to charge the batteries identified in paragraphs c) and c).
- f) The receiver shall be capable of operating from an a.c. 220V power supply .

3.1.6 Physical characteristics

- a) The receiver, antenna and ancillary equipment shall be waterproof and dustproof.
- b) The mass of the receiver, antenna, batteries and the ancillary equipment necessary to carry out operations identified in paragraph a) to c) shall not exceed 10 kg.

3.1.7 Service and spares

- a) Servicing and/or back-up facilities shall be available in South Africa. The vendor shall state the location of these facilities.
- b) A sufficient quantity of relevant spare parts shall be available in South Africa. The vendor shall state the value of spares available in South Africa.
- c) The vendor shall state the maximum period required to supply back-up facilities.

3.1.8 Compatibility with existing GNSS equipment and GNSS software

- a) The receiver, antenna and ancillary equipment shall be able to be successfully integrated with GNSS receiver hardware and software components presently used in Eskom to carry out the survey operations identified in paragraphs a) to c) without loss of present capability, performance and efficiency.
- b) Recorded satellite data from existing and proposed GNSS equipment shall not require data conversion or any manipulation of any kind at any time during the processing phases of recorded data.
- c) Eskom reserves the right to benchmark test all or some of the equipment (and software) offered to prove 100 % compliance with these standards.

3.1.9 Office software

The office software shall:

- a) be Microsoft Windows based and suitable for Windows 7 or later versions.
- b) be able to process raw data (display, edit and plot) using differential techniques and be able to generate and process standard DTM applications for overlay with raster and vector mapping backgrounds.
- c) be able to export captured, processed and edited data to standard GIS and CAD formats.
- d) be able to transfer files to and from receivers, hand-held data collectors, field/office computers and conventional survey instruments.

4. Authorisation

This document has been seen and accepted by:

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5. Revisions

Date	Rev	Compiler	Remarks
March 2018	2	Steven Tait	Document reformatted, content changed. This document supersedes SCSSCAAZ9. Compiler changed from B. Kruger to Steven Tait Approver changed from P. Crowdy to Adri De la Rey Authoriser changed from M. N. Bailey to Mfundu Songo
Nov 2012	1	B. Kruger	Final document approved Document for review created from SCSSCAAZ9

6. Development team

The following people were involved in the development of this document:

- Graham Hector - Engineering Surveyor WCOU

7. Acknowledgements

Not applicable.