Laser Remote Measurements of atmospheric pollutants (Las-R-Map): UV-Visible Laser system description and data processing

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Laser radar, more popularly known as LIDAR (LIght Detection And Ranging), is becoming one of the most powerful techniques for active remote sensing of the earth's atmosphere. Around the globe, several new lidar systems have been developed based on the scientific interest. Particularly, the DIfferential Absorption Lidar (DIAL) technique is only one which can provide the better accuracy of measuring atmospheric pollutants.

Using modern advanced techniques and instrumentation, a mobile DIAL system called laser remote measurements of atmospheric pollutants (hear after referred as Las-R-Map) is designed at National Laser Centre (NLC)–Pretoria (25˚45′ S; 28˚17′ E). Las-R-Map is basically used for measuring atmospheric pollutants applying the principle of absorption by constituents. The system designed primarily to focus on the following pollutant measurements, such as, SO_2, CH_4, CO_2, NO_2 and O_3. In future, the system could be used to measure few particulate matter between 2.5 μm and 10 μm, Benzene, Hg, 1,3-butadiene, H_2S, HF and Volatile Organic Compounds (VOC).

Las-R-map comprises of two different laser sources (Alexandrite and CO_2), optical receiver, data acquisition and signal processor. It uses alexandrite laser in the UV-Visible region from 200 nm to 800 nm and CO_2 laser in the Far-IR region from 9.2 μm to 10.8 μm. Such two different laser sources make feasibility for studying the wide range of atmospheric pollutants.

The present paper is focused on technical details of Alexandrite laser system, receiver optics and data processing.

The Alexandrite laser provides maximum power of about 4 W in fundamental mode. The laser operates at a variable pulse width from 4 ns to 400 ns and pulse repetition rate of 20 Hz. The laser optical properties are specified as less than 1 mRad for divergence and 6 mm for beam size. More details will be presented in the paper.