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RECEIV'AIR - BYPASSING OF ATMOSPHERIC ATTENUATION FOR SPACE BASED SOLAR POWER WITH AN AIRBORNE RECEIVER

Abstract

Due to diffraction limits, the use of sources on satellite with frequencies lower than 10GHz is leading to very large sources and receiver size. At 10GHz, antenna and receiver size should be of the order of 1km for power transmission from GEO. The use of higher frequencies allow a reduction of antenna/receiver size. However, due to high atmospheric attenuation, the use of RF sources over 10GHz is not possible due to transmission losses. Therefore, there is a large range of possible sources that have not been considered for SBSP. Indeed, most studies are usually considering a "ground based" receiver at sea-level.

In order to reduce or bypass atmospheric limitation, a solution could be to set the receiver higher in a mountain or a very high structure. However, achieving some kilometers of altitude with structures is not reasonable, while very high altitude mountains locations are limited and not so accessible. Some previous studies have considered an free-flying airship as a receiver performing frequency conversion coming with a high conversion efficiency cost, first from RF to electricity and then back to RF.

In the Receiv'Air study, we proposed to use a tethered airborne receiver. It presents some advantages in comparison to classical SBSP ground segment:

- the dimension of space and ground antenna could be reduced thanks to the use of higher frequencies,
- almost complete beam extinction by atmospheric absorption between airship altitude and ground, increasing safety for population and wildlife in case of beam depointing,
- lower ground footprint and material use, reducing impact on Earth.

This paper introduces the preliminary design of this receiving system composed of the airship, rectenna, power transmission cable and airship field. The proposed solution will be able to provide about 500MW of electrical power to electrical grid.