

SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

Author: Mr. Vitaliy Kapranov
RSC "Energia", Russian Federation, vitaliy.kapranov@rsce.ru

Dr. Vjatcheslav Tugaenko
Rocket Space Corporation Energia, Russian Federation, Vjatcheslav.tugaenko@rsce.ru

Dr. Roman Evdokimov
RSC "Energia", Russian Federation, Vjatcheslav.tugaenko@rsce.ru

Mr. Ivan Matsak
Rocket Space Corporation Energia, Russian Federation, f.mephi@gmail.com

DEMONSTRATION OF ISS BASED IR WPT SYSTEM AND CAPABILITIES OF ATMOSPHERIC
RESEARCHES.

Abstract

This paper summarizes and presents S.P. Korolev Rocket and Space Corporation Energia experience concerning space wireless power transmission (WPT) system project and describes way to investigate the effect of atmospheric phenomena on long vertical link from ISS to Earth surface.

WPT systems could be used for remote power supplying of the different consumers. First of all, there are autonomous technology modules for microgravity experiments, due to small and fixed receivers, micro- and nanosatellites, equipment for explorations on the Solar system body's surfaces during science planet missions, space transport vehicles with electric rocket propulsion systems.

RSC "Energia" develops ISS based WPT system and plans beginning of technology realization in the space experiment. The main components of proposed system are: fiber-coupled irradiation source based on semiconductor IR laser diodes or fiber laser with power of 50-1000 W in CW regime and power conversion efficiency above 30%; optics for creation 10 cm diameter beam in 1km distance with transmission near 95%; special GaAs/Ge and some other material omnidirectional photovoltaic receiver with dimensions of 20 cm for conversion of monochromatic IR irradiation with high energy density to electric energy with efficiency near 50%; fine guidance system for tracking objects with angular rates less than 3 deg/sec, based on laser tracker, retroreflectors on receiver, and dual pointing by motion platform and controlled steering mirror (overall accuracy near 5 mkrad). Part of chosen equipment was tested in experiments we provided recently. Real WPT system at a ranges of 100-1200 m in atmosphere with transmitted power levels of 40 W was demonstrated.

Main components of necessary WPT equipment – optoelectronic system for narrow beam creation and guidance system – can be used in atmospheric researches. Advances in laser technology are opening up new views of the Earth's atmosphere and placing the laser at the forefront of land research tools. Using laser space systems opens up even more opportunities. Special tunable laser or simple laser source with optics placed on space craft can produce narrow beam and point it to Earth surface. Irradiation received on surface will provide quite new information according to atmospheric characteristics (wind velocities, transmittance, turbulence characteristics and etc.).