

# Main construction features of the on board active hydrogen maser for Radioastron mission

A.Utkin, A.Beliaev, Y.Pavlenko

Vremya-CH, 67, Osharskaya Str., Nizhny Novgorod,  
603105, Russia, Tel: +78314210294

Email: [utkin@vremya-ch.com](mailto:utkin@vremya-ch.com)

The goal of the Radioastron project is to carry out investigations of various types of astrophysical objects of the Universe with an unprecedented high angular resolution in the centimeter and decimeter wavelength bands. The reference source of high-stable signal with extreme frequency stability characteristics during the time of observation is necessary for operation of the land and space interferometer of the project.

Two active hydrogen masers, which were made upon technical specification from Astro Space Center Lebedev Physical Institute of Russian Academy of Science (ASC), passed land tests and successfully operate on board of RadioAstron space observatory now<sup>i</sup>. General view of the on-board active hydrogen maser is shown in Fig.1.

To confirm possibility of application of the developed device as the on-board clocks for Radioastron project all produced masers have gone under numerous tests: mechanical, electric, temperature, and resource.

Main physical package design features:

- Considerable increase of mechanical durability of the construction;
- Using of space vacuum for pumping the microwave cavity;
- Additional pressurized volume, filled with dry nitrogen for electronic systems;
- Installation special microwave cavity for space application strengthened by a carbon fiber covering;
- Using of elements and materials suitable for reliable functioning.

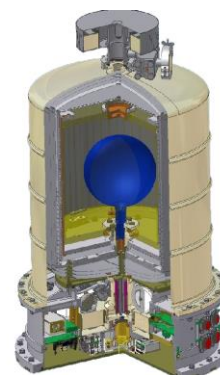


Fig.1:. Overview of an on-board hydrogen frequency standard.

Table 1. On-board H-maser performance

Parameter	Requirements	Measurement
Frequency instability (Allan variance)		
1 s	$3 \times 10^{-13}$	$1.89 \times 10^{-13}$
100 s	$7 \times 10^{-15}$	$6.55 \times 10^{-15}$
1 day (Frequency drift removed)	$5 \times 10^{-15}$	$4.5 \times 10^{-15}$
Thermal sensitivity (1/°C)	$5 \times 10^{-15}$	$4.7 \times 10^{-15}$
Magnetic sensitivity (1/Gauss)	$2 \times 10^{-14}$	$1.9 \times 10^{-14}$
Power consumption in working condition	60 W	52 W
Mass	60 kg	57 kg
Lifetime	10 years	Expecting more than 10 years

<sup>i</sup> N.S. Kardashev. «Radioastron»- is a radio telescope much greater than the Earth. Scientific program // Physics-Uspexhi, 2009. V. 179, № 11. P. 1191-1202.