

# ADVANCED ENERGY TECHNOLOGIES LTD.

## FOUNDED

in **2007**

[Grant received]

## CORE OF THE DEVELOPMENT

Miniature atomic clock (MAC) is a source of high stability frequency and precise time for radio electronic equipment.

## KEY INNOVATIONS

Atomic clock provides a frequency signal determined by quantum states of atoms. It guarantees high and long-term stability.

In addition, MAC has low power consumption and small size. It will allow using them, unlike the existing analogues, not only in bulky or stationary equipment but also in the modern portable and energy effective devices.

## IMPLEMENTATION OF THE DEVELOPMENT

ALREADY IN **2014**

## PEOPLE

### HEAD OF LABORATORY:

Vladimir L. Velichansky, PhD in Physics and Mathematics

### GENERAL DIRECTOR:

Alexander N. Kuznetsov, PhD in Engineering

## Applications of the development

**1**

### In communication systems with packet switching:

- satellite communication on the basis of low-orbit and geostationary spacecrafts;
- base stations of cellular and other types of wireless communication;
- access points and switches 4G+.

**2**

### In on-board devices of the spacecraft:

- small-sized satellite systems.

**3**

### In consumer navigation devices:

- reduction of synchronization time with the satellite clock in ~ 10 times, improvement of positioning in the city;
- inertial navigation (without satellite signals).

**4**

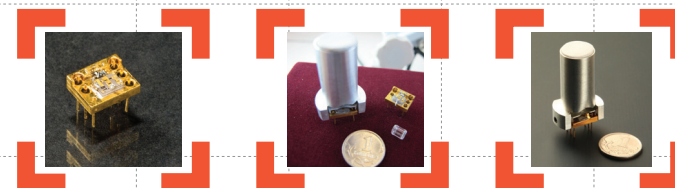
### In synchronization systems of complicated, distributed and remote objects:

- smart power networks;
- sensor networks;
- smart houses.

**5**

### In aircraft control systems:

- control, communication and navigation of UAV (unmanned aerial vehicles);
- avionics;
- bistatic radiolocation.



## Product features

**1**

MAC operating principle is based on the coherent population trapping phenomenon in rubidium (or caesium) atoms, which allows reducing size of the device in ten times as compared to exiting compact atomic references.

**2**

Having, furthermore, lower power consumption, better long-term stability and fast reach of the operating mode, MAC will replace precision atomic references and will find wide applications in portable devices.

**3**

The Russian development will use the best optical scheme of the reference resonance formation in rubidium atoms. Due to this fact it is planned that domestic MAC will in several times surpass its closest competitors by stability of output frequency.