

Radioelectronic Technologies in the Ultrahigh Resolution Electrocardiography for Early Diagnostics of Cardiopathologies¹

K. V. Zaichenko

Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg, Russia

e-mail: kvz_41@aanet.ru

Received in final form August 5, 2014

Abstract—The background, features and characteristics of the ultrahigh resolution electrocardiography (UHR ECG) method and its place among the other state-of-the-art electrocardiographic methods (ECG methods) have been described. The approaches and radioelectronic technologies used in the development of devices for the primary processing of electrocardiosignals (ECS) and algorithms of their secondary processing by the UHR ECG method were considered. In addition, the technique for performing experimental investigations on test animals and registration of ECG data were also considered in the search for new diagnostic signs of cardiopathologies. The possibilities of obtaining information regarding the development of ischemic heart disease by means of ECG signals registered by the UHR ECG method were described.

DOI: 10.3103/S0735272714110016

INTRODUCTION

There are no doubts nowadays that the problems of development of new instrumentation for breakthrough achievements in the field of physiology, fundamental medicine and other investigations of living systems should be solved by biologists, physiologists, and medical researchers together with representatives of the fundamental and applied natural and technical sciences. Their effective joint work involves the need of organization and coordination of such interaction. It is this complex problem that is handled by a think-tank of the leading scientific school (certificate NSh-3455.2012.8) “Radioelectronic and information tools for assessment of physiological parameters of living systems” (REIT LS). The members of this think-tank work at the scientific-and-educational Center “Biomedical Radioelectronics and Informatics” (SEC BREI) and at the Chair of Medical Radioelectronics (MRE) of the Saint Petersburg State University of Aerospace Instrumentation (SUAI).

This paper presents a new method of ultrahigh resolution electrocardiography (UHR ECG) that was developed by the radioelectronic system (RES) specialists in cooperation with physiologists and cardiologists. In addition, this paper presents the application capabilities of the innovative radioelectronic and information technologies employed in RES, biomedical investigations and in designing the state-of-the-art medical equipment.

The introduction of these technologies and development of devices for biology and medicine essentially expands capabilities and improves the technical specifications of many biotechnical and medical electronic systems. One of such examples is the creation in recent years of new ECG techniques in regard of improvement of both the hardware and the algorithmic and software means of electrocardiosignal (ECS) processing that provide new opportunities for diagnostics of cardiopathologies.

The importance of this study is corroborated by the fact that preventive measures, early diagnostics and the effective treatment of heart diseases are one of the priority tasks for both the medical workers and the technical specialists engaged in development of ECG equipment, because the largest number of serious

¹ This study was carried out with financial support of the Russian Foundation for Basic Research, Grants No. 14-07-00632 A and No. 13-07-00886 A.