Vol. 1, Spl. Issue 2 (May, 2014) e-ISSN: 1694-2310 | p-ISSN: 1694-2426
GV/ICRTEDC/46

CELLPHONE ANTENNA RADIATION IMPACT ON ECG (EFFECT ON HEART RATE)

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***Abstract*—** In this paper, Authors discussed active strategies for the classification of electrocardiographic (ECG) signals with 3-lead. The system consists of a hardware module for acquisition (Biopac mp150 module), a smart multimedia phone for checking the effect of radio frequency in 3G and 2G mode and finally a displaying module (PC or laptop devices). Information is collected in different mode. The system was assessed by testing different healthy person with the support of a medical doctor, for obtaining the effect of radiation on human body. Authors check the effect on HRV.

Keywords-*ECG, Biopac MP 150 module, Smart phone,3G and 2G.*

I. INTRODUCTION

Electrocardiography (ECG) is the acquisition of electrical activity of the heart captured over time by an external electrode attached to the skin. Each of the cell membrane that form the outer covering of the heart cell have an associated charge which is depolarized during every heart beat. These appear as tiny electrical signals on the skin which can be detected and amplified [1]. ECG signals are considered to be weak signals with signal amplitudes ranging from 100 V in the case of the EEG signal and up to 5 mV for the ECG signal [2]. An ECG usually requires a trained clinician to interpret it in the context of the signs and symptoms the patient presents with. It can give information regarding the rhythm of the heart. . Modern ECG machines often include analysis software that attempts to interpret the pattern but the diagnoses this produces may not always be accurate.

Radio frequency (RF) is a rate of oscillation in the range of around 3 KHz to 300 GHz which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. RF usually refers to electrical rather than mechanical oscillation [3]. The wave radiation mechanism from a source inside the human intestine to an on-body receiver was reported in [4] for narrowband and discrete frequencies within 150–1200 MHz.

In this paper, the 3G and 2G mobile radiation is characterized for in-body chest scenarios using time-domain electromagnetic analysis of ECG and a digital model of the human body that incorporates the frequency-dependent properties of human tissues.

We know that permanent ECG monitoring offers a wide range of promising applications, like wearable heart defibrillators, monitoring of risk patients or event recording. For permanent ECG monitoring applications in many researches dry electrodes were used because it provides many advantages over standard adhesive electrodes [5].

ECG signal can be classified in no. of segment which shows the different waves in ECG. A typical ECG wave of a normal heartbeat consists of a P wave, a QRS complex, and a T wave. Figure 1 depicts the basic shape of a healthy ECG heartbeat signal. The P wave reflects the sequential depolarization of the right and left atria and the QRS complex corresponds to depolarization of the right and left ventricles. The T wave reflects ventricular repolarization and extends about 300 milliseconds after the QRS complex.

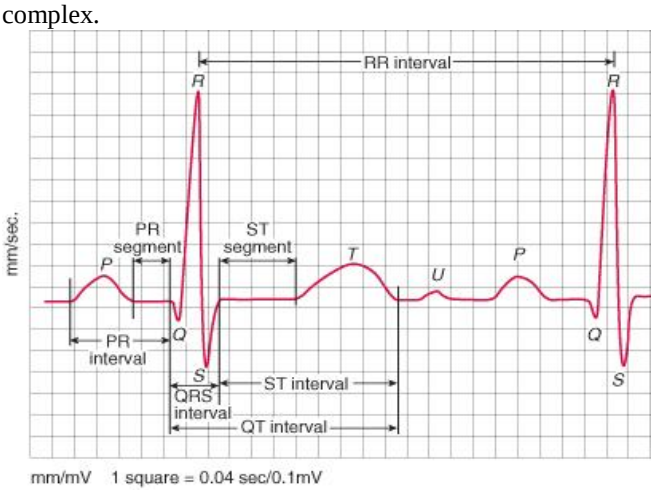

Figure.1.ECG classification [6]

In this paper, we discuss the effect of radiation due to 2G and 3G mobile on human heart with the help of ECG.

II. METHODOLOGY EMPLOYED

A. *Subject*

Many volunteers in the age group of 21- 30 years, mean age of 25 years participated in this study. They keep their cell phones switched off during the experiment which lasted for around 10-15 minute. This is done to minimize any kind of artifacts due to radiation of that phone on ideal state and try that subject should not do any physical movement from the other papers review we could understand we have to use different type of filter for minimizing the effect of noise and artifact that is why authors tried to take ECG with full care.

B. *Test protocal*

The collected ECG data usually contain noise, which include low-frequency components that cause baseline

wander, and high-frequency components such as power-line interfaces. Generally, the presence of noise will corrupt the signal, and make the feature extraction and classification less accurate. To minimize the negative effects of the noise, a denoising procedure is important for that purpose authors use different type of bandpass filter to perform noise reduction according to their need. Generally the cutoff frequencies of the bandpass filter are selected as 1 Hz–40 Hz based on empirical results. The first and last heartbeats of the denoised ECG records are eliminated to get full heartbeat signals. Authors could also apply thresholding method to remove the outliers that are not appropriate for training and classification of data.

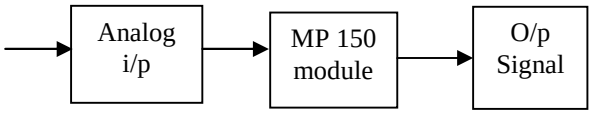

Figure 2: Block diagram of systems

In this paper authors are taking ECG in 3G and 2G mode for checking the effect on HRV by taking 10-15 min ECG of each subject in different-2 mode authors take the 3 min ECG in ideal, transmitting and receiving mode and check the effect of radiation with 3-lead ECG data using the MP150 data acquisition system shown in figure 3.

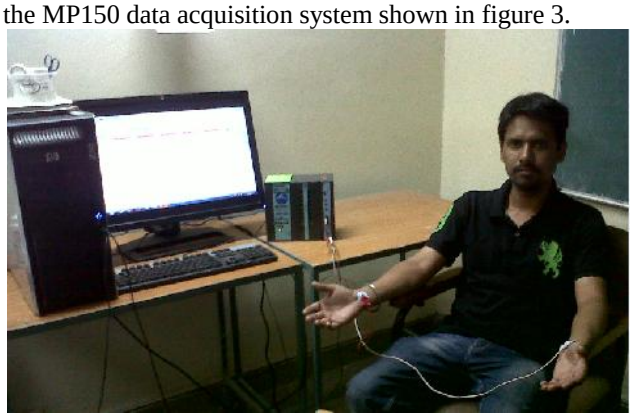
Figure.3. ECG Acquisition System

III. DATA ANALYSIS

BIOPAC MP150 software is used to analyze the ECG with the sampling frequency of 250 Hz. Recording is done at all 3electrode using 3 lead ECG method. Authors take different Parameter in different mode and check the effect for analyzing radiation on the human heart .

IV. RESULTS

As observed during the RF exposure there is a variation in the heart rate activity Authors take the sample and the value for the HRV in different mode. With help of the that values, authors could see the variation in different mode of radiation and on the basis of these values authors take a graph which shows the variation in heart rate with the change in mode on different sample authors collect for male and female depict in figure 4.

With the change in Heart rate the RR interpolation graph will vary (see Fig.5) their will be variation in this graph for diffenet mode.heart rate will vary according with the change in 2G and 3G mode.


Figure.4. Graphical reprsentaion of HRV

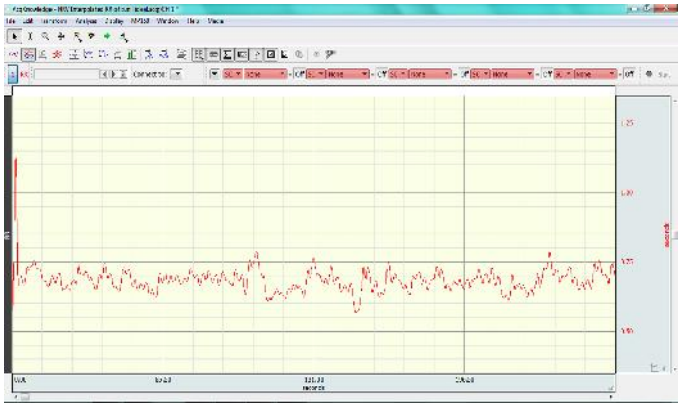
Figure.5 HRV interpolated RR

HRV spectrum will be also vary with change in RR interpolation graph(see Fig.6).

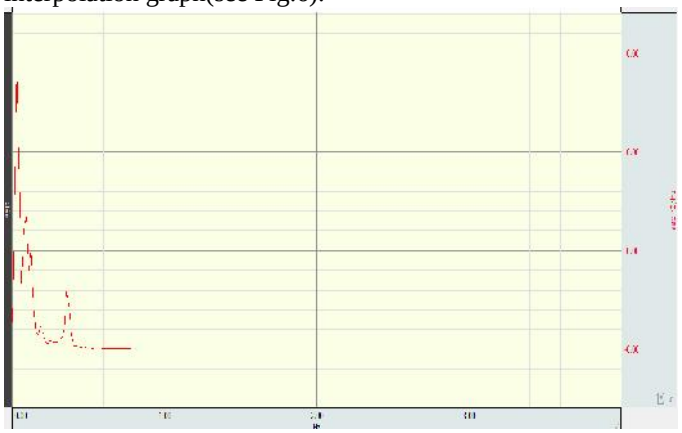
Figure.6.HRV spectrum

V. CONCLUSION

In this paper, a systematic analysis of ECG was discussed which involves analysis of HRV and other features. The results showed variation in HRV during RF exposure and data suggest if any person uses the mobile for long time in different mode the HRV will change and the heart rate will also change with the change in corresponding amplitude and frequency and with lower heart rate there will be chance of bradchardiya in those person because of RF effect. Also, the paper concludes that in some cases their will be a chance for tachcradiya due to RF exposure in 3G and 2G.

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