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Research Article

Performance Analysis of Tissue Impedance Measurement for Wi-Fi Transmission using QAM & QPSK

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Abstract

A quick and accurate estimation of the tissue impedance system over a wide range of excitation frequencies with a low cost wireless transmission technique has been presented. Windowing function is use to reduce the lobe effect. Signal is processed through cross- correlator and FFT to provide quick and accurate result for tissue impedance measurement. Impedance measurement helps to find out the tissue health. This method gives economy in computing power. Its simple design, low power consumption and quickness of result calculation make it different and useful technique for tissue impedance measurement. Here a method of fast and accurate impedance measurement and its wireless transmission through Wi-Fi has been proposed. QPSK and QAM modulation technique has been applied and it has been found that QAM based transceiver is more efficient. It has low noise power and higher modulation error ratio.

Keywords: *Tissue impedance, Wi-Fi, QPSK, QAM.*

1. Introduction

Various advantages of Wi-Fi make it popular in the field of wireless transmission applications. Now it has also its importance in medical field. In these days health related problems have been become very common to all. So to fight with health related issues it is necessary to have a system which may provide quick, accurate and continuous medical supervision. There is also a requirement of such type of medical devices which easy to use, comfortable, economic and portable. Tissue impedance measurement provides information about the health of tissue. With this information health related issues can be resolved. Wi-Fi a wireless transmission technique can be used to observe these measurement distantly as it is secure and reliable. This technology is low cost, fast and suitable for long distance communication than the other wireless technique such as Bluetooth.

Here a method has been discussed for impedance measurement of tissue which gives accurate, fast measurement of impedance and has simple design than previous methods.

The whole work has been arranged as: II section deals with the methodology which has been further divided in two subsections, first deals with method for tissue impedance measurement and second with the proposed Wi-Fi modulation technique(QPSK and QAM) for wireless transmission of measurement. III section deals with the application of tissue impedance measurement and Wi-Fi technology. IV section deals with conclusion and future scope.

2. Methodology

2.1 Tissue Impedance measurement

An excitation signal (or input signal) is given and $V(t)$ is generated that can be expressed as

$$V_{ch}(t) = \sin\left(2\pi\left(f_1 t + (f_2 - f_1)t^2/2T_{ch}\right)\right) \quad (1)$$

Here f_1 is initial and f_2 is final frequency. T_{ch} is the duration of signal pulse.

Window functions $W(t)$ are use to reduce the Gibbs or side lobe effect and to provide the smooth measurement effect. The actual excitation or input signal passes through the window function and amplitude tapered response signal $V_{exe}(t)$ obtained as

$$V_{exc}(t) = W(t).V_{ch}(t) \quad (2)$$

A voltage to current converter is used to convert this response from voltage signal to current signal$I_{exe}(t)$. The excitation current $I_{exe}(t)$ passes through a bio-impedance Z which is under the observation.The tissue electrical circuit is composed of resistor and capacitor.It provides a response voltage$V_z(t)$. This response voltage is cross-

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correlated with the actual excitation signal$V_{exe}(t)$. Finaly the signal obtained from the cross-corelator applied to the FFT. The result is obtained in form of amplitude and phase.

Figure.1 shows the block diagram for impedance measurement system.

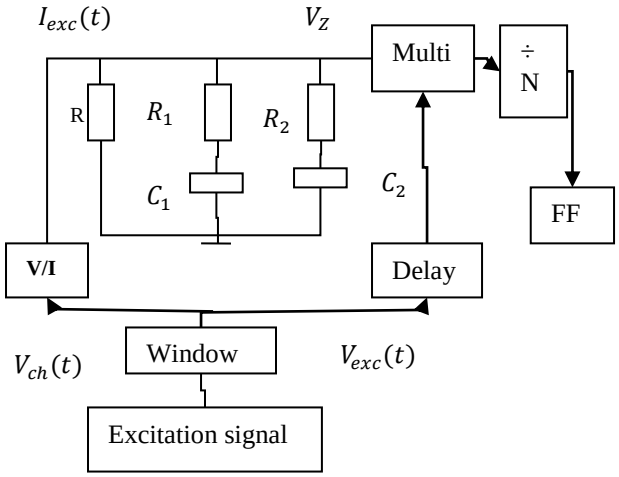

Fig.1 Block diagram of impedance measurement system

2.2Wireless Transmission Using Wi-Fi

Wi-Fi is a wireless transmission technology it uses radio waves to provide wireless high speed data transmission. No physical wired connection is needed between sender and receiver to transfer the data. It provides simple, low cost and secure wireless transmission.

2.3 Proposed Methodology

Following figure.2 shows the steps to be conducted for remote monitoring.

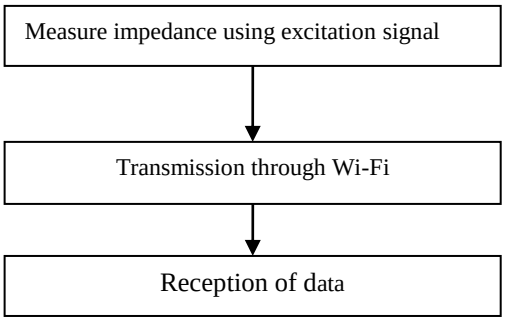

Fig.2 Steps for remote monitoring

2.4 Modulation used for Wi-Fi

Here QPSK and QAM modulation technique is used for modulating the Wi-Fi signal.

2.4.1 Quadrature Phase Shift Keying

Quadrature phase shift keying is known as QPSK, it is a modulating technique which is widely used for modulating the data signal. Here quadrature means the signal shifts in its phase states that are separated by 90 degrees and data into the modulator is separated into two channels such as I and Q. In quadrature phase shift keying two bits are transmitted simultaneously that is one bit per channels. The theoretical bandwidth efficiency of QPSK is two bits/second/Hz.

2.4.2 Quadrature Amplitude Modulation

Quadrature amplitude modulation is known as QAM, it is a modulation technique which is widely used for modulating data signal for radio communication. It has various advantages over other form of data modulation technique so it is widely used. In QAM two carriers shifted in phase by 90 degrees are modulated and there is a variation in amplitude and phase both comes as result. In QAM, both amplitude and phase variation are present, so it is also known as, mixture of amplitude and phase modulation. Data is split into two channels known as I and Q and two bits are routed to each channel simultaneously. Theoretical bandwidth efficiency of QAM is 4 bits/second/Hz. So QAM has higher data rate and batter bandwidth efficiency than the QPSK.

3. Result and Discussion

Since a tissue can be modeled in its electrical equivalent, its overall impedance can be measured to monitor many health problems. For distant monitoring, wireless transmission using best modulation scheme can be fruitful in medical applications.

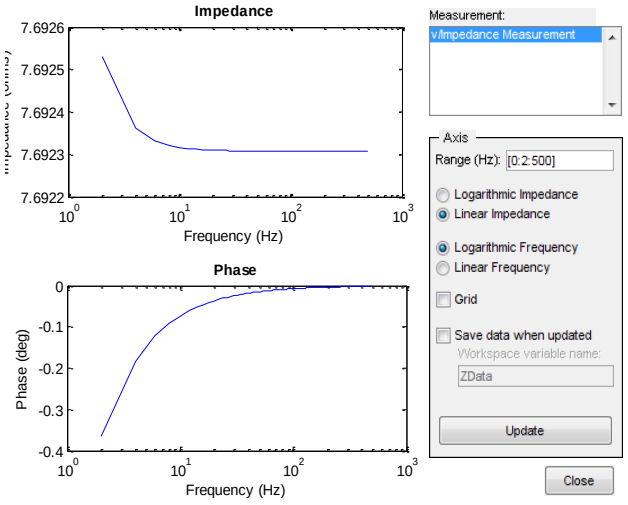

Fig.3 Magnitude and phase plot with frequency variation

As the frequency increases, magnitude of measured impedance decreases as shown in figure3 through intracellular region. While for transmission, the scatter diagram for both modulation techniques describes that QPSK gives a small cloud of symbol points while QAM gives a large cloud of symbol points. Small cloud of symbol points is due to increased noise power, hence gives

the low modulation error ratio while large cloud is due to high noise power hence gives the high modulation error. So QAM gives a large cloud of symbols which give a high modulation error ratio and decrease the noise power while QPSK gives a low modulation error ratio and increases the noise power.

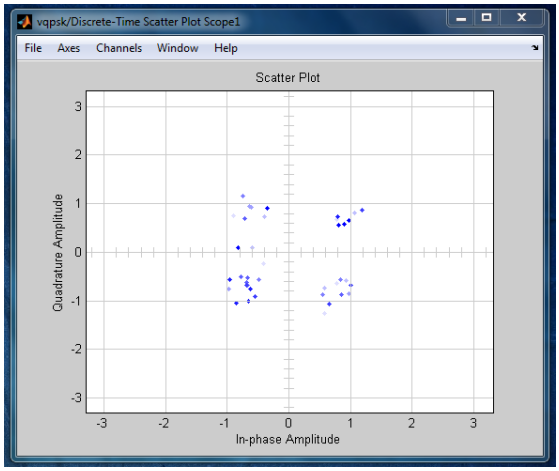

Fig.4 Scatter diagram of QPSK modulation

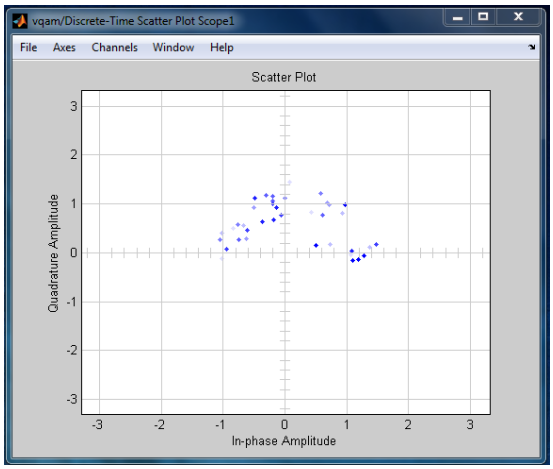

Fig.5 Scatter diagram of QAM modulation

From the simulation result of QPSK and QAM, is clear that QAM is used widely than QPSK for the for data transmission through Wi-Fi as QAM provides lower noise power, higher data rate than the QPSK.

4. Application

State of tissues can be easily detected with the help of tissue impedance measurement and it can help to diagnose many health problems such as skin hydration, cerebral monitoring, dental decay diagnosis and many more.

Wi-Fi is a useful real time access to the patient information immediate bedside for doctors and hospital staff. It is also easiest way for on-site consultation with doctors.

Conclusion

The proposed impedance measurement technique and Wi-Fi is useful for the distant monitoring of health issues. The tissue impedance measurement technique gives faster response by using FFT for a wide range of frequency and also provides considerable economy in computing power. Wi-Fi provides secure, reliable and fast transmission.As Wi-Fi allows to the LAN to transfer data without any cabling for client device and it reduce the cost for new network development. So this method is fast, accurate, secure, economic and reliable for resolving health care issues remotely.

References

S. Grimnes, O. G. Martinsen,(2000) Bioimpedance and Bioelectricity Basics, *Academic Press, San Diego*.

Y.Yang and J.Wang(2005) A design of bioimpedance spectrometer for early detection of pressure ulcer,Engineering in Medicine and Biology,proceedings of *IEEE 27th Annual Conference,pp6602-6604.*

Songer(2001),Tissue ischemia monitoring using impedance spectroscopy *Clinical evaluation Biomedical Engineering, vol. Master's Degree. Worcester: Worcester Polytechnic Institute.*

Introduction to Wi-Fi technology (2006) Retrieved on September *www.wi-fitechnology.com.*

Shailandra Kaushik(2008) An overview of Technical aspect for Wi-Fi Networks Technology *International Journal of Electronics and Computer Science Engineering.*

Paramvir Bahl(2009) White Space Networking with Wi-Fi like Connectivity *SIGCOMM'09, August 17–21, 2009, Barcelona, Spain.*

Liang Zhang, Xiaofeng Hu andTao Wang(2009) Proposal of A Star-16QAM System Based on Intersymbol Interference (ISI) Suppression and Coherent Detection *Proc. of SPIE Vol. 7514 75140V-2.*

Rob Flickenger(2008) Very Long Distance Wi-Fi Networks *NSDR Seattle, Washington, USA*

Vineet Sharma, Anuraj Shrivastav(2012) BER performance of OFDM-BPSK,-QPSK,-QAM over AWGN channel using forward Error correcting code *International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2*