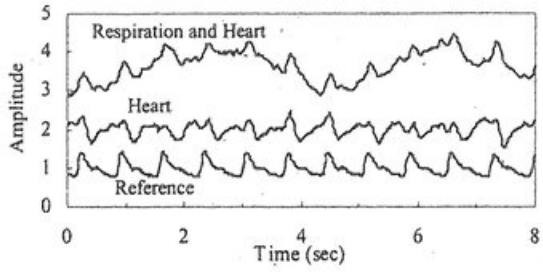
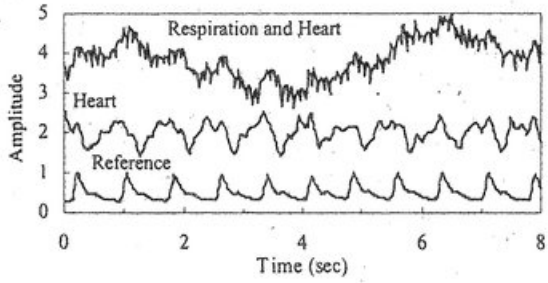
distances as large as one meter while using the VCO as the signal source.

Heart and respiration rates can be extracted from the data by finding all local maximums and discarding those below a threshold to avoid errors caused by noise or motion artifacts [12]. The average time interval between successive beats is the period of the signal, which can be inverted to determine the rate. Respiration and heart rates were found to be 14 breaths/min (0.23 Hz) and 84 beats/min (1.4 Hz), respectively, with the heart rate consistent with the rate obtained using the pressure pulse sensor.



(a)



(b)

Fig. 4. Respiration and heart signal (0.03-10 Hz), heart signal (1-3 Hz), and reference signal from finger pulse sensor with the subject one meter from the antenna. The local oscillator is a signal generator (a), and a VCO (b).

V. Conclusion

A novel microwave Doppler radio assembled using custom RFICs for DCS1800/PCS1900 base station applications has been described. The radio can detect heart and respiration rates of a subject at distances as large as one meter. The result demonstrates the feasibility of monolithic integration of Doppler radios in low cost silicon technology and the potential for future implementation of remote monitoring of vital signs in wireless communication networks.

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