Evaluating the Radio Frequency Environment is Needed Before Selecting a Wireless PSG System

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Introduction

Wireless technologies are being adopted in hospitals at an unprecedented rate and is expected to double by 2011.1 Wireless PSG is expected to play a major role in this growth as it permits real time sleep disorders assessment on the hospital floor. The evaluation of inpatients during their hospital stay can speed diagnosis, improve patient outcome, and prevent postoperative complications caused by undiagnosed sleep disordered breathing. Users of wireless PSG technologies, however, must be aware of radio frequency (RF) interference issues intrinsic to their environment. RF interference can cause several types of failures with wireless devices such as errors in data transmission, slow data transmission and complete device inoperability.2

Interference can come from other wireless devices and some non wireless sources. Common sources of RF in the hospital environment include cordless phones, paging systems, RFID, WLAN, WiFi and microwave ovens. Some sources of radiation that may interfere with wireless medical devices include fluorescent lights, power distribution, alarm systems and broadcast stations. Evaluating the RF environment before selecting a wireless PSG system can ensure that the best system for your environment is purchased.

Methods

The RF activity was collected over night in patient care areas of several hospitals using a computer based real time spectrum sweep tool. The RF was monitored in both the 900 MHz and 2.4 GHz band. The collected data was analyzed and plotted to determine the band utilization at each hospital location for each band. Guidelines suggest that band utilization of less than 25% is optimal, between 25 and 50% is a warning and over 50% is not recommended. After determining which band has the least utilization a wireless PSG system can be selected for use. Wireless PSG systems are currently available that transmit data in both the 900 MHz and 2.4 GHz bands.

Acknowledgments

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For further information

More information on this and related projects can be obtained at *www.clevemed.com*.

Conclusions

This study confirms the need for an RF analysis before a wireless PSG device can be selected. Every hospital environment will likely exhibit different frequency distributions, but these results suggest that different wireless bands may be needed in various environments.

Careful management of hospital equipment can greatly reduce the risk of equipment RF interference. An audit of existing wireless equipment and planning future frequency allocation is recommended.2 The RF environment outside the hospital may also change without warning. For critical care monitoring situations, the wireless medical telemetry bands (WMTS) (600 MHz and 1.4 GHz) assigned by a frequency coordinator at each facility is a new protocol that promises to eliminate interference and further improve the deployment of wireless devices in hospitals..

Literature cited

1. Frost and Sullivan market report
2. Gibson, Making Wireless Technology Work in Your Hospital, IT Horizons 2006 Edition, 30-36.

Results

An analysis of the RF environment in major hospitals in Baltimore and Cleveland showed contrasting results. The 900 MHz band in Baltimore was crowded, but if the wireless device is able to avoid that part of the spectrum the remaining frequencies maybe utilized. Figure 1 plots the percent of time that the channel is occupied and shows that the frequency between 905 and 908 MHz the occupancy peaks at over 50% utilization. Guidelines suggest that band utilization of less than 25% is optimal, between 25 and 50% is a warning and over 50% is not recommended. With increased band utilization the incidence of data loss increases. Therefore, in this case, additional devices operating between 905 and 908 MHz is not recommended.

The busiest band found in this study is the 2.4 GHz band at the hospital in Baltimore. The percent occupied is between 30 and 50% for nearly all of the band (Figure 2) suggesting that adding additional devices in this band is not recommended. Devices operating in this environment will likely have a reduced range compared to devices operating in a less occupied band.

The results for the 900 MHz band in a hospital in Cleveland shows a device that is frequency hopping throughout the band (Figure 3). This type of activity can be deceptive when examining a spectrum. When this device lands on a given channel it may cause transmission problems for other devices operating at that frequency even though the percent occupied is below 5% over time. Interferers such as this can be problematic for devices with high data rates like PSG systems. In situations like this it may be beneficial to sweep the RF environment and test the new equipment before deployment.

The 2.4 GHz band in the hospital in Cleveland is very open with a percent occupied below 2% for the whole band (Figure 4). An environment like this will allow a new wireless device to work in optimal conditions. New equipment in this range should operate very will with long range.

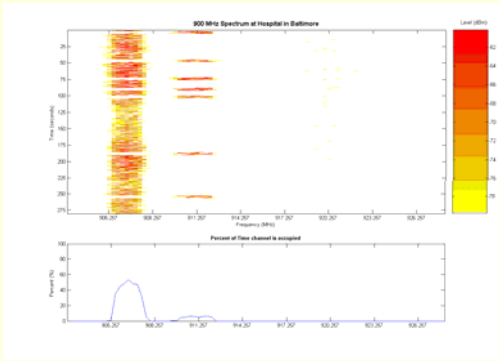

Figure 1

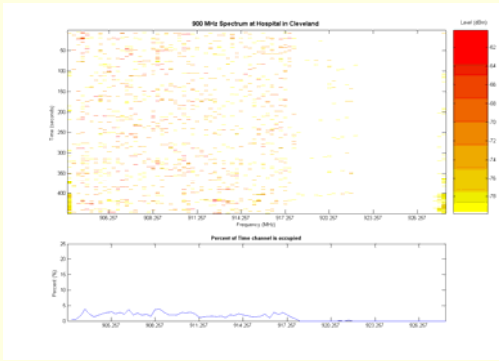

Figure 3

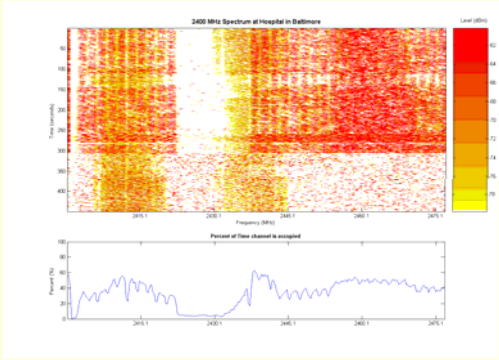

Figure 2

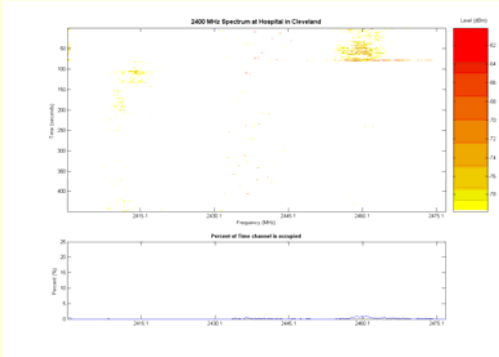

Figure 4