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ALBERTA CLINICAL ENGINEERING SOCIETY

The Alberta Clinical Engineering Society

Newsletter

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Presidents Letter

by Brandon Beaudry, President

In just a few weeks Edmonton will play host to the National Clinical and Biomedical Engineering Community And

ACES will be there in full force.

Your Executive, comprising the continuing education committee of CMBEC 24 have put special effort into ensuring that this years National Conference will be of maximum benefit to you, our members. We have hand picked courses to meet the needs of the Alberta BMET and we have negotiated membership pricing for our members. **We would like to thank the executive of CMBES for allowing ACES to be apart of this conference and for recognizing ACES as a joint partner.**

I believe both ACES and CMBES exist for the same reasons and share common goals. Goals to service the biomedical and Clinical Engineering Community, to further the field of Biomedical and Clinical Engineering and to foster the exchange of information and the vast experiences of the individuals involved with these fields.

The ACES executive works hard to ensure that the members of the biomedical community in Alberta find their field rewarding and continually challenging. It is the hope of the executive that continued educational opportunities, open forums, experienc-ed lecturers and strong social events will add to the depth of experience, foster stronger working relationships and simply create a better working environment.

It has been an honour and a privilege to act as president for two consecutive terms. I have seen many groups and many individuals provid-ing substantial support for our society. I would like to personally thank all those who have chosen to be a part of our society and our efforts over the last year and a half. You have not only made my job easier, you made it very rewarding as well. I look forward to talking with everyone again at this years conference.

A strong group of ACES members will be required to ensure ACES success at the conference. Everyone with a little time to spare at the conference is encouraged to contact me directly. A membership booth will be on hand to accept new memberships and to pass out ACES merchandise.

One last reminder. **Don't forget to wear your ACES membership card (name tag) and your ACES pins.** Replacement pins will be available at the conference for $5.00. Anyone needing replacement cards should contact me via email at bbeaudry@-cha.ab.ca. We will make sure they are available at the door.

Special Recognition

by Brandon Beaudry, President

As President of the Alberta clinical Engineering Society, on behalf of all our members, I would like to congratulate **Duncan Cook.**

Duncan has been a Biomedical Technologist with the University of Alberta Hospital for 9 years. He has worked for the past 4 years on the Renal Team providing service in the Northwest Territories, and throughout all of northern Alberta, to patients on the renal dialysis program.

Duncan has been a strong supporter of ACES in the past, participating in many of the Society's functions as well as providing lectures on the Renal Dialysis technology. His personality and communication skills have allowed him to move into other projects successfully and for the past year he has worked closely with Sandy Salter, Renal Patient Care Manager, as **Projects Coordinator, for the Northern Alberta Renal Program.**

Last month Duncan Cook took his experience one step further as he became the successful candidate for the position of Regional Space Planner.

It is the belief of the ACES executive that Duncan Cook deserves special recognition for his efforts and success in furthering the field of Biomedical Engineering. He has taken his background, his education, and his personal skills and broadened the base of the biomedical field.

I have asked Duncan to submit a short article describing the responsibilities and expectations of this new position.

The Role of A Biomedical Technologist in 1998

by Duncan Cook

ACES, as requested here is as short synopsis of my new role within the Capital Health Authority. After only two short weeks in my new role I am just learning the scope of work involved with this position. This space planning position is one of two within the referral hospital system, based at the Royal Alexandra / Glenrose sites. (The other at the University of Alberta site) The space planners are responsible for the management of space within existing facilities and the planning of new or redeveloped space on the respective sites. Space management includes allocation of space , maintaining an inventory of space occupancy, and maintaining the accuracy of the CADD drawings of the facility. New construction or renovations are requested by developing functional programs for submission to government. Once functional programs are funded they become projects and are then led by Capital Health's project management team.

I am sure this new role will exercise all of my customer service skills as it seems everyone has issues with the space in which the work. The challenge for me will be to try to help the Royal Alexandra / Glenrose facilities evolve to reflect the way patient care is now delivered and will be in the future.

Cheers! Duncan

RFI Testing Of The Proxim RangeLAN 2 Wireless LAN

by Ray Cislo, P.Eng.[1], Eva Henningson, CET[1], Jon Sala, CET[1], Todd Shandro, CET[1], Warren Ngo, CET[2]

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Introduction

Concern over the potential of harm to patients due to medical equipment malfunctions resulting from radio frequency (RF) transmitters interfering with the operation of medical equipment has resulted in closer scrutiny of RF transmitters entering hospitals. Significant attention has been given to cellular telephones and portable 2-way radios, both of which have been shown to be capable of interfering with the operation of medical equipment such as infusion pumps, ventilators, infant incubators, and motorized wheelchairs (1, 2, 3, 4). These medical devices have been known to exhibit unexpected behaviours such as altered display outputs and unexplained alarms when cellular telephones and portable 2-way radios were used in close proximity to them. However, the nature of radiofrequency interference makes it extremely difficult to predict which medical devices will be affected, and in what manner. Even identical models of the same device may respond differently, *or not at all.*

While most of the information presently available in the literature deals with cellular telephones and portable 2-way radios, the principles of operation and concerns associated with cellular telephones entering the hospital are equally applicable to RF wireless local area networks (LANs). Reflecting policies and practices within the Capital Health Region (5), new RF technologies and devices such as wireless LANs must be compatible with medical equipment used in patient care areas. The least expensive and most practical method of determining compatibility is ad hoc testing following an established protocol.

Purpose

The purpose of this study was to examine the behaviour of medical equipment exposed to RF energy emitted by a wireless LAN system, determining to what extent, if any, the medical equipment selected was susceptible to this energy and to then record any observable interference effects. The results of testing would then establish whether or not the wireless LAN could be used in proximity to medical devices in pre-selected areas of the hospital.

The Proxim (Proxim, Inc., Mountain View, California) wireless LAN system tested consists of

(1) a RangeLAN2 PCMCIA Model 7400 wireless LAN adapter card ("PC card") (CAD$800-$1000) that is installed in a notebook computer. Embedded within that portion of the card which extends beyond the PC card slot, within a protective rubber cover the thickness of the PC card, is the antenna; and

(2) a RangeLAN2 Access Point Model 7510 base station (approximately CAD$2,600). The Access Point is a stationary device which connects to the hospital's wired LAN. An antenna links the wireless notebook/PC card combination to the hospital's wired LAN via the Access Point.

The system uses frequency hopping spread spectrum technology operating at a nominal frequency of 2.4 Ghz, a power output of 100 mW, and data rates up to 1.6 megabits per second (Mbps). For comparison purposes, traditional wired LANs offer data exchange rates of 10-100 Mbps.

One of the main benefits of spread-spectrum wireless LAN technology is the ability to roam at the point of care without loss of connection to the network. Staff are able to move from room-to-room with their notebook computer cart and input information or access records resident on the hospital network, in areas where running a cable is either impractical or impossible. Use of this system permits clinicians access to StrokeNet, a Disease Guidance System (DGS) developed by Synapse Publishing Inc. and presently undergoing trial at the University of Alberta Hospital. A DGS is a dynamic, on-line, decision-making care map used in assessing and treating patients having particular diseases for which the DGS application is intended.

METHOD

Sixty-one devices taken from or representing devices normally used on Units 4G3, 4G4, and the Emergency Centre at the University of Alberta Hospital were tested; it is on these Units that the wireless LAN system is to be used. Mechanical or simple electromechanical devices were not subjected to testing; equipment subjected to testing included ventilators, infusion pumps, pulse oximeters, physiological monitors, ECG recorders, EEG systems, and many others. Where possible, two samples of each device were tested, the assumption then being made that these results were generalizable to all devices of an identical make and model. In some cases, only one sample of a particular device was tested because only one such device was used in the patient area or it was impossible to secure more than one sample of the given device.

The test method used is based on a draft of standard C63.18 being prepared by the Institute of Electrical and Electronics Engineers (IEEE) entitled "Recommended Practice for an On-Site, Ad hoc Test Method for Estimating Radiated Electromagnetic Immunity of Medical Devices to Specific Radio-frequency Transmitters". In a large room free of other RF sources, the device under test was placed at the centre of concentric half-circles taped to the floor with radii of 1.0m, 0.5m, and 0.25m. Susceptibility observations were also made at a distance of 10 cm from the device under test, achieved by holding the notebook computer/PC card combination and manually sweeping the PC card antenna over all exposed surfaces of the device under test. Self supporting devices were placed at the centre of the test grid; all other devices were placed on a plastic tubular platform centred on the grid. The notebook computer/PC card combination was placed on a wheeled wooden cart; the RangeLAN2 Access Point base station was positioned approximately 15m away from the test area, connected to the hospital's computer network. A software routine was created to simultaneously transmit and receive a continuous stream of data between the access point and the notebook computer/PC card combination.

With the device under test positioned at the centre of the grid and set to its most commonly used operating mode, the notebook computer/PC card combination was wheeled along each of the concentric lines and in the case of the 10 cm test distance, was manually swept over exposed surfaces of the device under test. If the notebook computer/PC card combination could possibly be used closer to a medical device than the minimum 10 cm distance recommended in the test protocol, then the minimum distance was adjusted to this minimum operational distance. In most cases, the PC card antenna was brought to within less than 10 cm of the device under test in order to observe device behaviours under worst case conditions. The RangeLAN2 PC card was tested with its antenna in both vertical and horizontal orientations.

The behaviour of the device under test was characterized using the IEEE observation codes shown in Table 1. (attached)

RESULTS

Of the 61 devices tested, only 3 showed any signs of altered behaviour; all other devices showed no change in operation. The observations noted for the three affected devices are summarized in Table 2. (attached)

Two Nellcor Puritan Bennett Symphony N-3100 NIBP (Non-Invasive Blood Pressure) units were tested initially, with one responding to the notebook computer/PC card combination. Following exposure to the RF field (PC card antenna held horizontally within 5 cm of the unit's front panel, by the right hand corner of the device), the front panel indicators blanked out and then the unit initiated its self-test cycle, as it would during initial power up. Despite repeated attempts, the observed behaviour could not be duplicated. A third N-3100 NIBP was subjected to the test and showed no evidence of interference effects.

The Emergency Centre's only Medtronic Model 5375 Demand Pulse Generator was tested and found to show interference effects; these effects were repeatable and independent of antenna orientation. With pulse rate set at 94 beats/min, sensitivity set at approximately 8 mV, and output set at 15 mA, the notebook computer/PC card combination was swept over the pulse generator. No effects were observed until the PC card antenna was within 1-2 cm of the generator's front face, between the sensitivity and output control knobs. The pulse rate was affected, varying between 46 and 55 beats/min - far less than the setting of 94 beats/min. Although other output characteristics of the pulse generator may have been affected, only the pulse rate was monitored with an external test instrument.

The hospital operates two BMSI (Nicolet) System 5000 Digital EEG (electroencephalograph) systems but only one was accessible for testing. With patient leads connected to the scalp of a volunteer and the system operating normally, an EEG technician monitored the output waveforms on a nearby television monitor as the notebook computer/PC card combination was swept along the leads and over the exposed surfaces of the lead connector box/preamplifier. No effects were observed until the PC card antenna was brought to within 5 cm of the connector box/preamplifier, at which point distortion of several waveforms was observed.

DISCUSSION

Radiofrequency interference by its very nature is often difficult to observe or duplicate. The length and orientation of a jumper wire on a printed circuit board, or a small break in the shielding of a device's cover for example, can make one sample of a device susceptible to interference, whereas 20 samples of the same device may show no effect at all. Generalizing test results from one or two samples to an entire population of devices may therefore be problematic. Similarly, unexplainable and unreproducible effects are sometimes observed, as was demonstrated in this study.

From the perspective of "true" radiofrequency testing, the IEEE test method used in this study cannot be considered to be "scientifically rigorous". It is however a simple, real world *ad hoc* screening tool, permitting devices to be quickly evaluated using a recognized and reproducible method. Practically speaking, the test method is a hospital's most practical, least expensive method of evaluating RFI susceptibility and therefore the acceptibility of permitting a particular RF transmitter to be used in a patient care area.

With the exception of three devices, all others tested showed no evidence of RFI susceptibility to the RangeLAN2 product. In the case of the three devices affected, the results for the Nellcor Puritan Bennett N-3100 NIBP could not be reproduced a second time with the unit under test nor did two other samples of the same device show any observable effects. This, together with the fact that the effect happened within 5 cm of a particular location on the device permit the results to be noted but they do not affect use of the RangeLAN2 within the patient areas selected.

Regarding the Medtronic Demand Pulse Generator and the BMSI (Nicolet) Digital EEG system, the effects observed occurred when the PC card antenna was placed within 2 and 5 cm of the devices respectively. Under normal and expected conditions of use, the notebook computer/PC card combination will never come this close to either of the devices. Once again, the test results are noted but do not affect use of the RangeLAN2 within the patient areas selected.

Based on these findings, the RangeLAN2 PC card and Access Point base station are considered acceptable for use on Units 4G3, 4G4, and the Emergency Centre. Should new, potentially susceptible devices be purchased for use on the Units, each device should be subjected to the testing described in this study.

References

(1) Dube D, Harris H, Waldon V. Effects of Cellular Phones and 2-Way Radios on Medical Equipment (unpublished findings). University of Alberta Hospitals, Edmonton; 1993/1994.

(2) Silberberg JL. Medical Device Performance Degradation Due to Electromagnetic Interference: Reported Problems. EMI Control in Medical Electronics, Interference Control Technologies (Conference), June 15 - 17, 1992.

(3) Lange S. Cellular Phones and Transmitting Devices in Critical Care Areas. Internal Hospital Study; Regina Plains Health Centre; November 23, 1992.

(4) ECRI. Electromagnetic Interference and Medical Devices: An Update on the Use of Cellular Telephones and Radio Transmitters in Healthcare Facilities. *Health Devices* 1996 Feb-Mar; 25(2-3): 101-106.

(5) Royal Alexandra Hospital. Cellular Telephones and Portable 2-Way Radios. Policy Number 1103; Royal Alexandra Hospital, Edmonton, Alberta; July 15, 1993.

CMBEC 24

Course Highlights

If you have not yet received your 1998 CMBEC Preliminary Program please feel free to contact the CMBES Secretariat directly at **(613) 993-1686**

The preliminary Program is also available on the internet at: **http://www.cha.ab.ca/clineng/cmbec24**

Remember all ACES members qualify for CMBES Member Pricing.

A reminder to everyone that registrations for courses must be received **immediately.** Late registrations run the risk of missing out on the popular courses with limited positions or courses will be canceled by June 1st if participation is low.

Windows NT Support Fundamentals

This is level I of a two part course presently offered by the Micro Computer Institute and covers the operation of Windows NT for workstations. ACES hopes to offer level II later this summer. This course is very popular but unfortunately **space is very limited** as it is a hands on workshop. Get your registrations in early.

Advanced Web Design

Another very popular Micro Computer Institute course. This course is designed for individuals with some background into HTML and basic web page format. Participants will learn to submit and retrieve data from an access database using Visual Basic script and Active Server Pages (ASP). ACES is offering a special deal to Biomedical students who are willing to support the ACES web page for "1 year ". **ACES will pay an additional $50.00 towards the students course fees over and above the already reduced cost of $200.00.** Interested students should contact Brandon Beaudry at 492-6711 or by email at bbeaudry@cha.ab.ca

PSpice Circuit Engineering

This is a hands on work shop which will take place at a NAIT computer lab. Participants will learn to create their own circuit designs, test their design via simulation and complete basic PC board layouts. Each participant will receive a CD ROM version of the program to be install on their home computer.

Health Care Information Systems

The clinical community is rapidly moving towards a completely networked system. This course will cover the basics of the HP initiatives into patient care networking with a look at the HL 7 and DICOM standards. Examples from the Capital Health Region will also be reviewed.

Plastics and Polymers Repair and Recognition

Similar to the very successful and well received course provided by ACES at last years conference, this course provides insights and hints on repairing various plastic or complex polymer components. Learn to recognize various polymers before attempting the repair through flame testing and characteristic analysis. This years course will take place at the NAIT Plastics Lab for a strong hands on experience.

Data Communications and Networking

For those who missed Gordon Blinston in November, here is a second opportunity to acquire a better understanding of a working hospital network. Gordon provides a very in depth look at the components of the Network with enough terminology to keep even the seasoned Network administrator excited

Medical Device Incident Investigations.

This course should be mandatory for all BMETS across Canada. How many of us could confidently walk into a patient care area after a serious incident has occurred involving a piece of medical equipment and thoroughly investigate the problem. Dr. Bruce Hansel reviews mechanisms of injury, equipment design issues, staff training, preservation of evidence, impounding of equipment, inspecting and testing of devices, interviews, third party investigators and investigation of skin burn incidence.

Anatomy and Physiology of Cardiovascular and Respiratory Systems and Diagnostic Measurements

An in depth look at anatomy and physiology as it pertains to biomedical engineering and vital signs monitoring. Offered by Deb Welder, Clinical Educator with HP

Fundamentals of Ventilators

A very thorough course on ventilator service with a comparative look at various makes and models. This course is now being taught by a qualified BMET and RT from the Hospital for Sick Children in Toronto., John Coutlee.

Communication in Plain English

The perfect course for anyone who finds themselves continually in front of an audience. Learn to improve your communication skills and public speaking ability. Chris Grabiec also provides some hints on creating effective presentations.

Preparing for the Biomedical Exam

The traditional CMBEC course assisting anyone completing the certification process. Review sample test questions and highlight specific areas of study.

Medical Device Regulations and Standards

Many changes are occurring in the area of medical device standards. Keep up to date on these changes through this half day seminar.

For more information on the above courses or the rest of CMBEC 24 see the *CMBEC 24 CCGB Preliminary Program.*

JOIN ACES !!

To enjoy the benefits of ACES, and ensure that you continue to receive the ACES newsletter and meeting notices, Become a member ! Complete the following Information form, and return with payment in the amount $10.00 to:

The Alberta Clinical
Engineering Society
c/o The University of Alberta Hospitals
Clinical Engineering Room 0D1.00
8440-112 Street
Edmonton, Alberta, T6G 2B7
ATTENTION: Brandon Beaudry

Name: ________________________

Hm Address: ___________________

City/Prov: ______________________

Postal Code: _________

Ph: (___)_________

Email: ________________________

Business Information:.

*Company:*_______________________

Position: ________________________

Department: ____________________

Room: _______

Address: ________________________

City/Prov : ___ __________________

Postal Code: ________

Ph:(_____)____________*Ext:*______

Email: _________________________

Table 1 IEEE Observation Codes

	Observation Codes
1.	No change in operation
2.	Cessation of operation without visible and/or audible alarm.
3.	Cessation of operation with visible and/or audible alarm.
4.	Change in function or delivered therapy with alarm.
5.	Change in function or delivered therapy without alarm.
6.	Reboot or power down with loss of data.
7.	Reboot or power down without loss of data.
8.	Manual reset required to continue operation.
9.	Change in mode or operational state without alarm.
10.	Change in mode or operational state with alarm.
11.	Visible and/or audible alarm with continuation of function.
12.	Alarm malfunction or failure to alarm.
13.	Change in measured and/or displayed data with change in operation.
14.	Change in measured and/or displayed data without change in operation.
15.	Change in audio indicator.
16.	Distortion of displayed waveforms.
17.	Display malfunction.
18.	Recorder malfunction.
19.	Error message or service code.

Table 2 Summary of Observed Interference Effects

Device	Observation	Distance
Number 18 Nellcor Puritan Bennett Symphony N-3100 NIBP	Change in mode or operational state without alarm	Within 5 cm of the device's front panel, by the right hand corner
Number 43 Medtronic Model 5375 Demand Pulse Generator	Change in mode or operational state without alarm	Within 1-2 cm of the device's front face, between the sensitivity and output control knobs
Number 56 BMSI (Nicolet) System 5000 Digital EEG	Distortion of displayed waveforms	Within 5 cm of the system's patient lead connector box/preamplifier