REPORT NO. BF-I-7
FEBRUARY 9, 2011

TO: The Chairperson and Members of the
Business and Facilities Standing Committee

FROM: Superintendent of Education

SUBJECT: **USE OF WIRELESS TECHNOLOGY**

1. Background

Our goal is to provide safe, supportive environments for all students and staff. Wireless communications are recognized to be a relatively new technology in use in our schools, and ensuring the responsible use of this technology is important. Supporting our risk management strategy the Simcoe County District School Board (SCDSB) has been very active ensuring that the wireless communications devices in all of our facilities meet or exceed the standards set by all regulating authorities.

The Board has sought information regarding this matter from a number of governmental bodies, including the federal and provincial Ministries of Health, Ontario's Ministry of Education, the Ontario Agency for Health Protection and Promotion (OAHPP), Ontario's Chief Medical Officer of Health, and the Simcoe Muskoka District Health Unit. These authorities have supported the position that wireless communication in our schools is safe, and that it does not pose a risk to student or staff health. This position is supported internationally as well through other governmental agencies and the World Health Organizations. Health Canada and Industry Canada have also been consulted and verify that wireless communications are safe. The SCDSB has information from these organizations on its website at:
http://scdsb.on.ca/programs-services/information-and-communication-technology/

In November 2010, the SCDSB also sought testing of the wireless communications system by an outside expert, Dr. Tony Muc, President and Chief Physicist Radiation Health and Safety Consulting, and a former Assistant Professor and now an Adjunct Lecturer at the Dalla Lana School of Public Health Occupational & Environmental Health Division, University of Toronto, to confirm that the wireless communication access points employed by the Board were in keeping with the guidelines of Health Canada, and Industry Canada. The report attached is the result of this investigation (APPENDIX A).

Dr. Tony Muc was asked to evaluate and measure the levels of electro magnetic radiation emitted by the access points at two schools, Mountain View Elementary School, and Collingwood Collegiate Institute (CCI), both located in the town of Collingwood. Dr. Muc had been enlisted to present to the Board of Trustees the scientific basis of wireless communications at the April 21, 2010 Facilities Standing Committee meeting of the SCDSB. Dr. Muc's experience with the development and understanding of Safety Code 6, the regulation that governs the levels that are acceptable for exposure, qualifies Dr. Muc as an expert in the field.

2. Wireless Communications

The Simcoe County District School Board (SCDSB) has been recognized as a leader in Ontario in the development and implementation of wireless computer networks in our schools. At this time we have wireless capabilities available in all of our facilities supporting the principles of the SCDSB Information and Communication Technology (ICT) Strategic Plan (2009) that include the provision of equity and accessibility to technology in our schools.

Wireless communications (commonly referred to as WiFi) allow staff members and students to access the Internet through portable devices in virtually any setting. Wireless promotes the use of technology by making technology available for the teacher and the learner in all locations, for small and large groups and with flexibility in groupings and subject areas.

WiFi enabled devices (laptops, Teacher Notebooks, blackberries) connect to the Internet and the SCDSB Intranet through access points located in buildings to provide coverage and connectivitiy for all users. The link is made between the computing device and the access point (also known as a router) as a signal is sent, and information goes to the device from the access point.

In the SCDSB the establishment of the wireless network has positioned the Board well to take advantage of the many positive outcomes for students and staff in the area referred to as 21st century teaching and learning.

3. Status of Wireless Projects in the SCDSB

The SCDSB is completing the final phase of implementation so technology is available in every room and every teaching and learning area in the Board as portable classrooms are connected through access points to the Board's network. The implementation of wireless access points began in 2006 and a full scale implementation was undertaken soon thereafter. It was completed in 2009. Access is close to being universal in our buildings for all Board-owned devices.

Guest wireless for teaching staff was piloted in two secondary schools, Elmvale District High School and Eastview Secondary School, in the 2009-2010 school year. Full availability of the Guest Wireless network for staff was begun in November 2010. The Guest Wireless network allows staff to bring non-Board owned devices to locations, allowing the staff members to use their own devices to access the Internet. Staff members are expected to complete an Acceptable Use agreement in order to use the Guest Wireless network, which is filtered at the lowest level of access for security purposes. Guest Wireless does not allow staff to use the Board's network.

Student Guest Wireless is in the pilot stage with three secondary schools, and two elementary schools beginning implementation in March 2011. Student Guest Wireless will require student and parent permission and agreement so that the students may bring in their own electronic devices. Filtering is to be in place at a stringent level to support the acceptable use of these devices. Following the pilot of Student Guest Wireless it is intended that full implementation will proceed in the 2011-2012 school year. This will provide students at SCDSB schools with access to the Internet when they are at SCDSB facilities, while maintaining the security of the Board network and Intranet.

4. Report from Dr. Muc

The report from Dr. Muc was presented to staff in late December 2010, following his visits to the schools on November 25th, 2010.

Following receipt of the report, staff requested that Dr. Muc answer the questions found below for the purposes of clarification.

QUESTION: What is the level of mW/ cm2 that is set under Safety code 6 for exposure for those not 'classed as RF and Microwave Exposed Workers (including the General Public)'? The challenge for us to understand how the levels relate to the acceptable if we do not know what the lowest level of 'unacceptable' readings are.
RESPONSE: For WiFi signals any level UP TO 1 mW/cm2 averaged over any 6 min period is acceptable. So, arguably, 1.00.....001 mW/cm2 and any greater level would be unacceptable.

QUESTION: In section 4.2 the report states that the reading at location #1 at Mountain View, on Hollinger's laptop is referenced at 1.342 mW/cm2. Can you relay to me what that means with regard to exposure since in 4.3 the levels below 1 that you mention are 'acceptable'?
RESPONSE: The level observed at Hollinger's laptop would be unacceptable if it were to be accessed in some significant way for more than about 4.5 minutes at a time. However, one would have to wear the computer like a hat to actually be "exposed" to the observed level, an exceedingly extraordinary way to use the computer. Other measurements verified that at locations where a normal user would normally be [head and hands] the levels were well below1mW/cm2.

QUESTION: Do you have a layperson's explanation as to why the level in that location (on the laptop) was so far removed from all other values recorded?
RESPONSE: Perhaps a red hot stove element might serve as an example. Direct contact will produce a severe burn in a very short time. Coming as close as, say, 1 mm for several minutes will also produce a burn, but not likely as severe. Being as close as 10 cm would not likely produce a burn at all though warmth might be sensed and being farther away (walking around in the kitchen), even though "exposure" (at a very low level) still exists does not produce any discernible effect. The specific location on the laptop where the relatively high level was observed represents what is often called a "hot" spot - like the red hot stove element. It may be where the laptop's antenna is mounted or perhaps close to the CPU is mounted or where a particularly active data bus passes.

QUESTION: What would that mean as far as exposure for a student sitting at that computer?
RESPONSE: To use the red hot stove element analogy, the student is walking around in the kitchen - far enough from the hot spot to be out of harmis way.

QUESTION: In section 4.2 the level is said to drop off from the high registered to below the detection level and to ND in a very short distance. In the paragraph above this statement it is stated that the meter's calibrated measurement limit is 0.040 mW/cm2 (How was the 1.342 reading measured if the limit is 0.040?).

RESPONSE: By way of clarification it would be preferable to say the lower limit of the meter's calibrated measurement RANGE is 0.040 mW/cm2.The upper limit is something like 1999 mW/cm2 (I would have to get the meter and its manual back to check the actual value). The 1.342 reading is WITHIN the calibrated measurement range. Many readings, even most readings in some situations, are less than 0.040. Such readings represent a response of the meter but the value may be off by a much larger percentage than values within the calibrated range. The meter's display may show a reading as low as 0.001 or even 0.000. In principle the percentage error (uncertainty) of the latter is infinite!
The measurement of power densities in the report is in mW / cm2 – microwatt per square centimeter. A microwatt is a 1000th of a watt.

Dr. Muc's findings were consistent with the safety levels that we expect for all of our students and staff. All were found to be well within the safety standards prescribed by Health Canada's Safety Code 6.

Other school boards in Canada, including the Bluewater District School Board, have commissioned or conducted tests of wireless installations in the interest of demonstrating that there is no risk to student health. The levels found at the schools in Bluewater DSB were also found to be well within the range found by Dr. Muc during his investigation in SCDSB schools, and can be found on their website (http://www.bwdsb.on.ca/).

5. Conclusions

The SCDSB continues to communicate with staff, parents and the wider community about the benefits of the technological innovations that are important aspects of the move to 21st century teaching and learning in our schools.

The wireless communication system established in the SCDSB has, throughout the tests completed by Dr. Muc, demonstrated that the wireless access points are safe and pose no health risk to our students and staff. The findings of Dr. Muc's report validate the position of the Board that wireless communications and devices are an important element in our information and communications technology strategy.

The importance of the use of technology in our schools is significant in our agenda to advance student learning. It is also important for the SCDSB to provide safe and supportive environments for all of our students, our staff and our community. The report from Dr. Muc reinforces that the wireless technology in use in the SCDSB is safe.

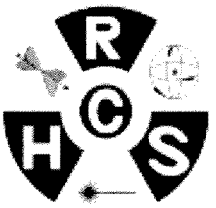
6. Report Status

This report is provided for information.

Respectfully submitted by:
John Dance

Superintendent of Education

February 9, 2011



RADIATION HEALTH and SAFETY CONSULTING
64 Donlea Drive, Toronto, Ontario, M4G 2M4

Evaluation of RF and Microwave Levels at Mountainview Elementary School and Collingwood Collegiate Institute Collingwood, Ontario

2010 11 25

Carried out for:

Mr. John Dance
Superintendent of Education, Area 3
Simcoe County District School Board
Education Centre
1170 Highway 26
Midhurst, Ontario, L0L 1X0

1. INTRODUCTION

Concerns about radiofrequency (RF) and microwave health and safety issues for students at Mountainview Elementary School (MES), Collingwood, Ontario were raised with the Simcoe County District School Board (SCDSB) as it began to roll out wireless local area network (LAN, also called WiFi) internet access services. The concerns focus on wireless routers used to provide connections to the Internet for computers on school property and about the exposure of computer (particularly laptop) users, especially children and young adults.

Early in April, 2010 Mr. John Dance, Superintendent of Education, Area 3 of the SCDSB, contacted Radiation Health and Safety Consulting (RHSC) for advice and assistance in addressing concerns about RF and microwave exposures. Initially, there was interest in making arrangements for a presentation to the members of the board regarding the safety of wireless access points (APs). On Wednesday, April 21, 2010 the author attended a meeting of the board at the Education Centre, 1170 Highway 26 and presented an overview of the occupational and environmental health and safety issues associated with non-ionizing radiation in general putting WiFi and the APs in the context of technological applications across the whole electromagnetic spectrum. In particular a number of important distinctions (specifically between ionizing and non-ionizing radiation) were emphasized, and other common applications of RF and microwave energy were cited (specifically cell phones and microwave ovens) as relevant by way of prevalence, exposure levels and operating frequencies.

Subsequently the board decided it wanted to proceed with RF and microwave measurements at MES. Because the necessary instrumentation had been returned to its manufacturer for re-calibration it was not possible to schedule the measurements until late fall. When arrangements were finally made, it was decided to include measurements at Collingwood Collegiate Institute (CCI) as well.

On Thursday, 2010 11 25, between approximately 1300 h and 1515 h, measurements of RF and microwave levels were made near wireless APs throughout MES including one in a pod of portable classrooms situated west of the main building. Measurements were made at CCI between approximately 1530 h and 1730 h. Both MES and CCI are situated in an urban setting within the town of Collingwood surrounded by relatively low density single family residential neighbourhoods with a scattering of small apartments and commercial properties in the immediate vicinity.

At the time the measurements were being carried out MES was operating in a normal manner with students, teachers and staff conducting routine activities while at CCI classes were finishing and students were dispersing although extracurricular activities were still under way. In attendance at MES while the measurements were being carried out were Greg Elliott (Manager of Information Technology Services, SCDSB), Robert Hollinger (Systems Engineer, SCDSB), Stephen Small (Systems Engineer, SCDSB), Doug Paul (Principal, MES) and, from time to time, Don Shackell (Vice-Principal, MES). John Dance (Superintendent, Area 3, SCDSB) was also in attendance for part of the

time. At CCI, Greg Elliott, Robert Hollinger and Stephen Small were in attendance. The author is grateful to all for their assistance in locating and providing access to the various WiFi access points in both schools.

2. BACKGROUND

The electromagnetic spectrum is a valuable and limited resource, not unlike air and water and land, with ever increasing demands put upon all of them by human activities. As soon as the electromagnetic spectrum began to be utilized during the first part of the last century it rapidly became obvious that one user's activities could adversely affect another user's activities unless certain conditions are met, again not unlike air, water and land. Consequently national governments around the world have established controls on the use of the electromagnetic spectrum.

The government of Canada is no exception[1]. It allocates specific frequency ranges within the electromagnetic spectrum for various civil and military uses. Most of the allocations provide for exclusive use of a specific range of frequencies and are subject to conditions specified in a licence. There are some ranges called the Industrial, Scientific and Medical (ISM) bands that are not subject to most of the conditions associated with licenced use. The only condition they must meet is that devices operating in the ISM bands must not interfere in any way with users outside the ISM bands. Two ISM bands, at 2.45 GHz and 5.8 GHz, are currently in use for unlicenced applications such as microwave ovens, residential portable (wireless) telephones and (wireless) routers for localized computer networks (wireless LANs or WiFi systems).

It is important to note that unlicenced does not mean unregulated. All installations and devices are subject to the limits specified in Health Canada SC-6. Furthermore all installations and devices take into account and meet local standards and guidelines to limit occupational and general public exposure.

AM and FM Radio, TV, police and emergency communications, air traffic control systems including radars, cellular telephone, pager and commercial data transmission systems all operate in specifically allocated and licenced bands. Their operating frequencies are spread over the whole spectrum and with the advent of lasers and fibre optics corresponding radio communications applications are moving to frequencies beyond the microwave range, into the infrared and visible regions of the spectrum. Towers scattered throughout the countryside accommodate one or many different antennas or dishes to serve the many needs of the communities.

It is also to be noted that the study and use of electricity, magnetism and the electromagnetic spectrum in general is not at all "new" as is so often claimed. Among the earliest work was that of Galvani and Volta in the late 1700s followed by Gauss, Maxwell, Hertz and Roentgen in the 1800s and then Einstein, Tesla, Townes and Schawlow and Gould in the 1900s. Each and every one of the associated advances in physics led to advances in engineering and technology to bring useful, truly "new,"

1 See <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01678.html>

applications into existence. Some exceptions notwithstanding (e.g. tobacco, CFCs, asbestos), it seems that each innovation, regardless of its provenance, also spawns its own wave of alarm and quackery (the proverbial purveyors of bear grease and snake oil, magic crystals, pyramid power, etc.) that, with the passage of time, in **almost all** cases is dispelled and discredited by results arising from more detailed scientific investigations.

3. MEASUREMENT RESULTS

Measurements were carried out with a Holaday Industries Broadband RF Field Strength Meter Model HI 4012. It provides a calibrated response to electric field levels over the frequency range of 500 kHz to 5 GHz. The meter was set to display far field equivalent power density. The smallest value that the meter can display is 0.001 mW/cm^2 which normally implies a detection limit of 0.0005 mW/cm^2. However, the manufacturer's specifications for the meter state that its detection limit is 0.040 mW/cm^2 for calibrated readings. Therefore recorded values of less than the manufacturer's stated detection limit are only to be interpreted as the barest indication of the presence of emissions from a source and not to be taken as precise or calibrated readings. Values recorded as N.D. or N.D.x indicate that there was not even an approximate indication of emissions detected, i.e. the display did not deviate from 0.000 mW/cm^2 (see also Section 4.2 below).

The probe incorporates an integral spacer such that the detector assembly cannot be placed closer than 5 cm from any source or other object.

Attention was focused on the APs themselves since it was anticipated that, even with the probe in contact, the emissions would be near the limits of detectability of the measurement system. At any given location the display was also closely observed as the probe was moved between adult head and waist level or to head and table level of a seated child.

For ease of reading, the meter, being digital, only updates its display approximately twice each second. However, it actually samples the field approximately twenty times each second. If the display were to show every reading it would usually be changing so rapidly as to be unintelligible. In order to ensure that short duration high readings are not missed the meter's MAX HOLD feature displays the highest detected value during a given time period at a fixed location or while the probe is moving along a certain path between two points, say walking along a corridor or scanning around an AP or over the surface of a microwave oven, computer or monitor. Such highest detected values are designated with an "x" in the tables of measured values below.

The values reported in Tables 1 and 2 below were noted at the specific locations indicated at MES and CCI respectively. For reference purposes the locations are numbered sequentially from 1 to 12 at MES and 13 to 21 at CCI. The reference number for each measurement location is shown on the floor plans of MES and CCI in Figures 1 and 2 respectively.

Table 1. Measured Power Densities, Mountainview ES

Location Ref. No.	Room	Description	Power Density mW/cm^2
1	104A	- numerous measurements - centre, near counters, head and waist levels	N.D.
		- Hollinger's laptop, download traffic	
		- keyboard, 60 s	0.022x
		- keyboard, 60 s, repeat	0.018x
		- head level	N.D.
		- in contact, display, bottom	1.342
2	104	E end, just outside Rm. 104A	
		- in contact with AP	N.D.
		- adult, head and waist levels	N.D.
		- seated child, head and table levels	N.D.
3	117	- entry, NW corner, waist level	N.D.
		- in contact, microwave oven	0.022
4	C102	S end, near door to Rm. 111	
		- in contact with AP	N.D.
		- along corridor between stage and Rm. 104A	0.011x
5	103	E end, Stage	
		- as close as possible (AP ~5 m above floor)	N.D.
6	119	- in contact with AP (30 s)	0.064x
7	120	- in contact with AP (30 s)	0.019x
8	118	- in contact with AP (30 s)	0.003x
9	108	- between Rm. 118 and Rm. 108	N.D.x
		- in contact with AP (30 s)	0.108x
10	123A	- in contact with AP (30 s)	0.001x
11	123A	- along windows, SE corner, waist level	N.D.x
12	Portables (pod of 6)	- between Rm. 123A and W entrance	0.012x
		- AP in NW portable (not accessible)	N/A
		- S centre portable, NW corner, ceiling (30 s)	0.013x

Note: Values above 0.003 cause heart irregularities in adults at 2.4 GHz frequencies! This is well below the limit of detection for the meter used in this report!

Table 2. Measured Power Densities, Collingwood CI

Location Ref. No.	Room	Description	Power Density mW/cm^2
13	C102	- near Rm. 105	
		- in contact with AP (30 s)	0.005x
		- waist level	N.D.
14	106B	- at entrance, waist and head level	0.015x
		- at server near floor, back wall	0.005x
		- near monitors back wall	0.038x
	104A	- near monitor, NE corner	0.015x
	104	- microwave oven, E wall, in contact	0.100
15	C102	- between Rm. 105 and Rm. 109	N.D.x
		- near Rm. 109	
		- in contact with AP (30 s)	0.004x
		- at waist level	N.D.
16	C103	- between Rm. 109 and Rm. 121	N.D.x
		- near Rm. 121	
		- in contact with AP (30 s)	0.016x
		- at waist level	N.D.
17	C105	- between Rm. 121 and Rm. 134	N.D.x
		- near Rm. 134	
		- in contact with AP (30 s)	0.009x
		- at waist level	N.D.
18	C111	- between Rm. 134 and Rm. 144	0.004x
		- near Rm. 144	
		- in contact with AP (30 s)	0.053x
		- at waist level	N.D.
19	C111	- between Rm. 144 and Rm. 148	N.D.x
		- near Rm. 148	
		- in contact with AP (30 s)	0.016x
		- at waist level	N.D.
20	178	- between Rm. 144 and Rm. 178	0.005x
		- in Rm. 178	
		- in contact with AP (30 s)	0.013x
		- at waist level	N.D.
21	175	- between Rm. 178 and Rm. 175	0.007x
		- in Rm. 175	
		- in contact with AP (30 s)	0.019x
		- at waist level	N.D.

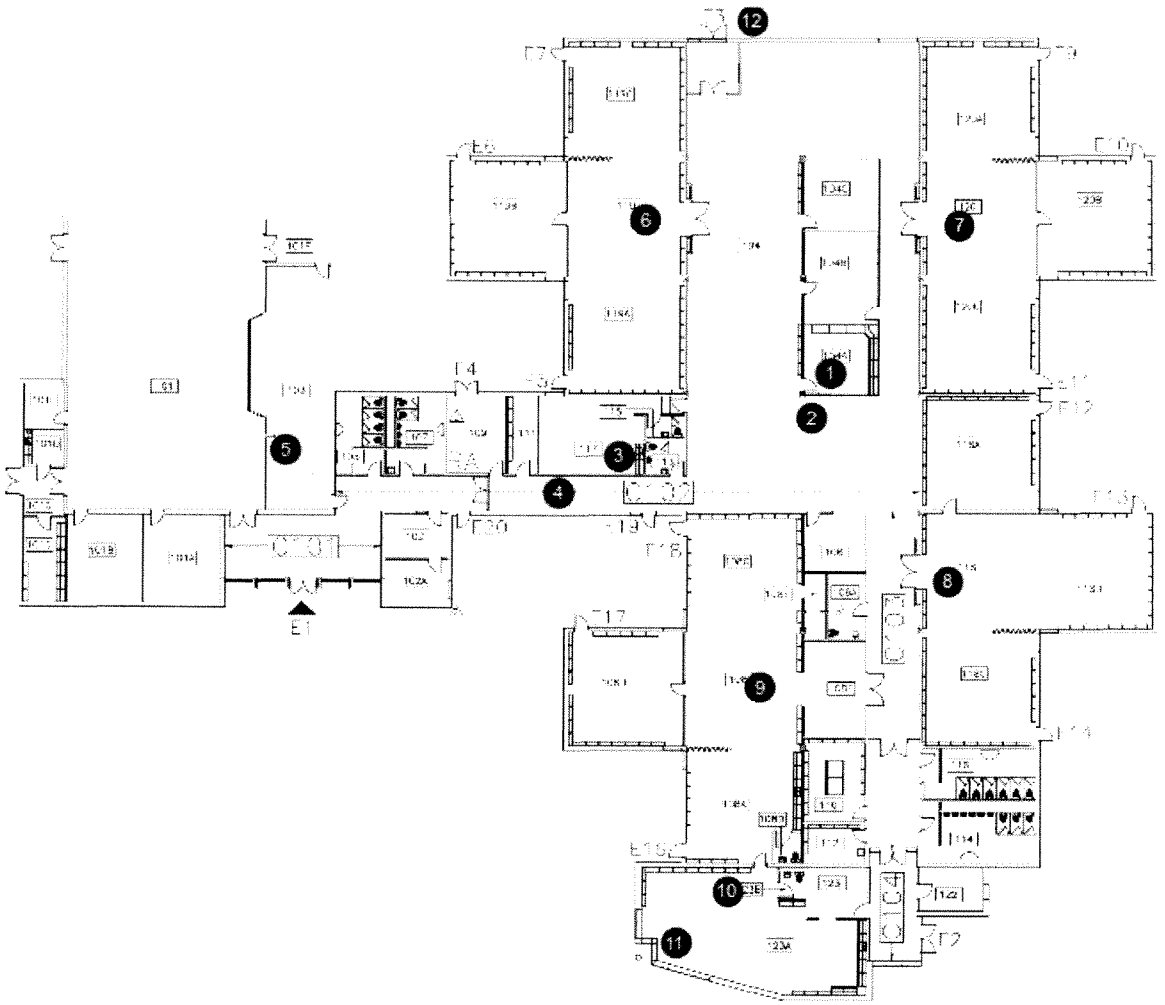


Figure 1. Measurement Locations, Mountainview School

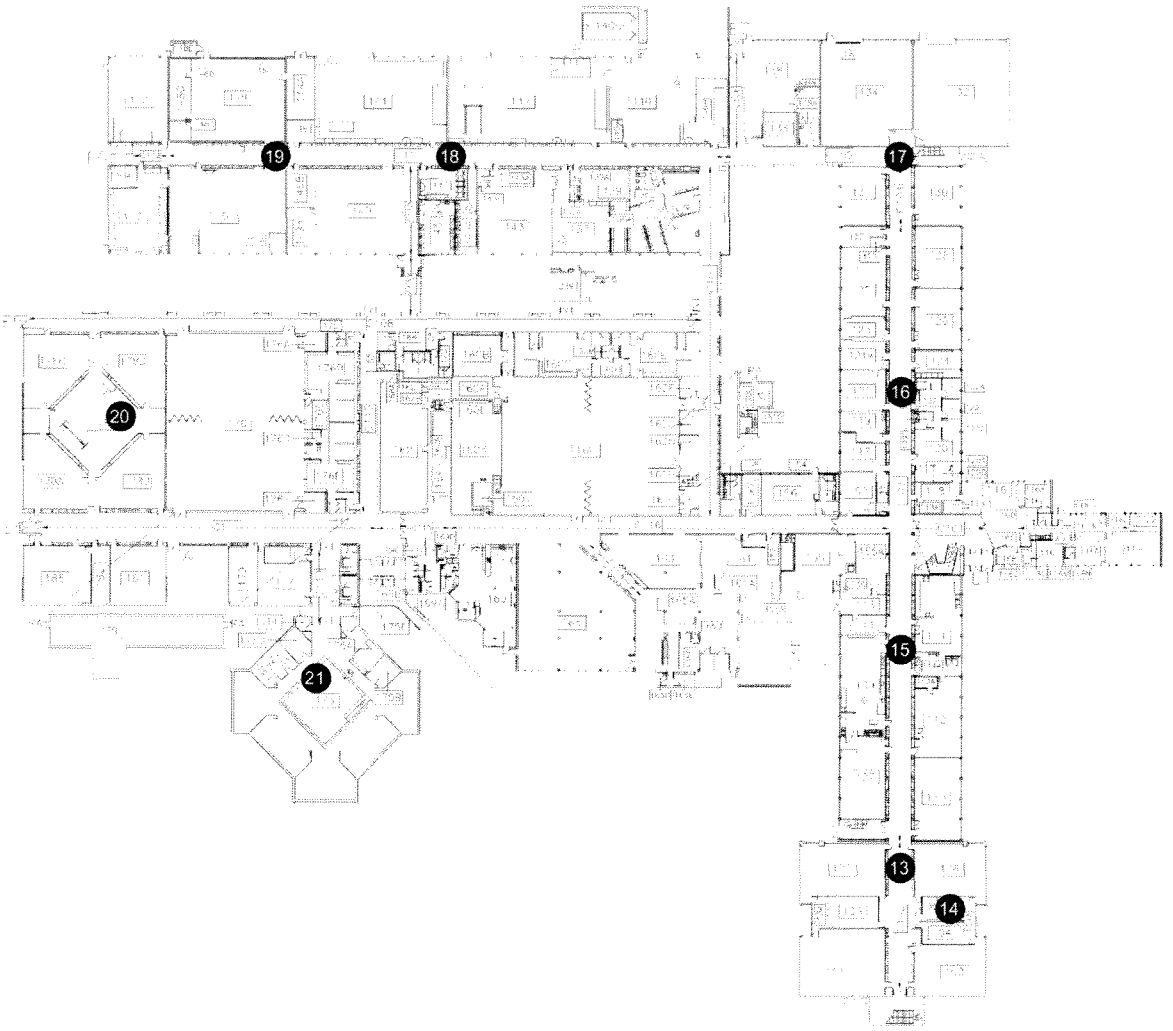


Figure 2. Measurement Locations, Collingwood CI

4. DISCUSSION

4.1 The Sources

The APs being used in SCDSB schools are designed to operate in one or both of the 2.4 GHz and 5 GHz ISM bands. The number and location of the APs in any given school depends on the expected volume of data, number of users anticipated, reliability and coverage requirements that the APs are intended to meet. At any given time only selected bands and selected channels within the bands are active in accordance with the needs of the users. Since the measurements were carried out with a broadband meter the reported values cannot be directly attributed to any specific band or channel and represent a total level arising from both the school and neighbouring areas. Of course when the probe is physically in contact with a source, one of the APs, a laptop or a microwave oven it is to be assumed (quite reasonably) that virtually all of the indicated emission level is attributable to that closest source.

4.2 The Measured Values

The underlined insertions (Ref. NN) or paragraph headings below refer to the Reference Numbers for the locations identified in the first column of Tables 1 and 2.

Ref. 1 - 4, 9, 11 - 21 Of 24 levels recorded at adult head or waist level (including one at seated child head and table level) 18 indicated no detectable emission (N.D.). Of the remaining 6, the highest level was 0.015 mW/cm^2 observed near the entrance to the server control and service room (Ref. 14) at CCI normally only accessed by authorized staff. The next highest level (recorded in areas normally accessed by students) was 0.012 mW/cm^2 recorded at MES (Ref. 12) as the maximum (at adult waist level) along a path from Rm. 123A, through Rms. 108A, 108 and 108F, along corridor C103 and across Rm. 104 to the west entrance of MES which is used for access to the schoolyard and the pod of portable classrooms. While these measured values indicate the presence of emissions, none of them exceeds the meter's calibrated measurement limit of 0.040 mW/cm^2.

Ref. 1 The highest level observed was 1.342 mW/cm^2 with the probe in contact with a laptop near the top edge, middle of the keyboard. The level was observed to be highly localized dropping off to below the detection limit of the meter at distances of about 10 cm from the high point and to N.D. at the user's head.

It is important to note that values reported as N.D. do not mean levels are absolutely 'zero' but rather that they are not only below the calibrated detection limit of the meter but also below its limit to display any reading at all. Clearly there is sufficient signal for the WiFi equipment to operate successfully and reliably. That is because, within their specific channels, the WiFi receivers are designed to be extremely sensitive and can work with levels many, many times (factors of thousands to millions) lower than the detection limit of the meter or the limits specified in Safety Code 6.

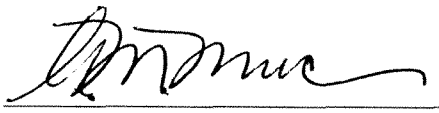
4.3 Limits for Exposure to RF and Microwave Fields

According to Health Canada Safety Code 6, for the frequency range from 1.5 GHz to 15 GHz, which includes the APs used in SCDSB Schools, levels less than 1 mW/cm^2 are considered acceptable "for Persons Not Classed as RF and Microwave Exposed Workers (Including the General Public)" regardless of exposure duration.

In the U.S., limits specified in the standards established by the American National Standards Institute (ANSI) in association with the Institute of Electrical and Electronic Engineers (IEEE) and the the Food and Drug Administration's Center for Devices and Radiological Health (USFDA – CDRH) are very similar (although not totally identical) to those of Health Canada Safety Code 6. The same can be said for the limits specified by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) which has brought together experts from across Europe and provides guidance to the Eurpoean Economic Community (EEC). On the broadest front, such a general consensus on limits flows from the EMF Project established by the World Health Organization (WHO) which has been working toward global harmonization of exposure standards and guidelines by promoting and facilitating interchange of the results of research among all the member nations.

5. CONCLUSIONS

The RF and microwave electromagnetic field levels in a representative sample of areas normally accessed by students at both MES and CCI are a factor of at least 25 below the exposure limits specified in Health Canada Safety Code 6 for "Persons Not Classed as RF and Microwave Exposed Workers (Including the General Public)." All the observed levels are far below exposure limits currently established or proposed by major international or national agencies or organizations for public (including children) or occupational exposures.



A.M. (Tony) Muc, Ph.D., P.Phys.
President and Chief Physicist