Safe Living Technologies Inc.
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Guelph, ON N1L 0A6,
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support@slt.co
www.slt.co

Radio Frequency Radiation Assessment

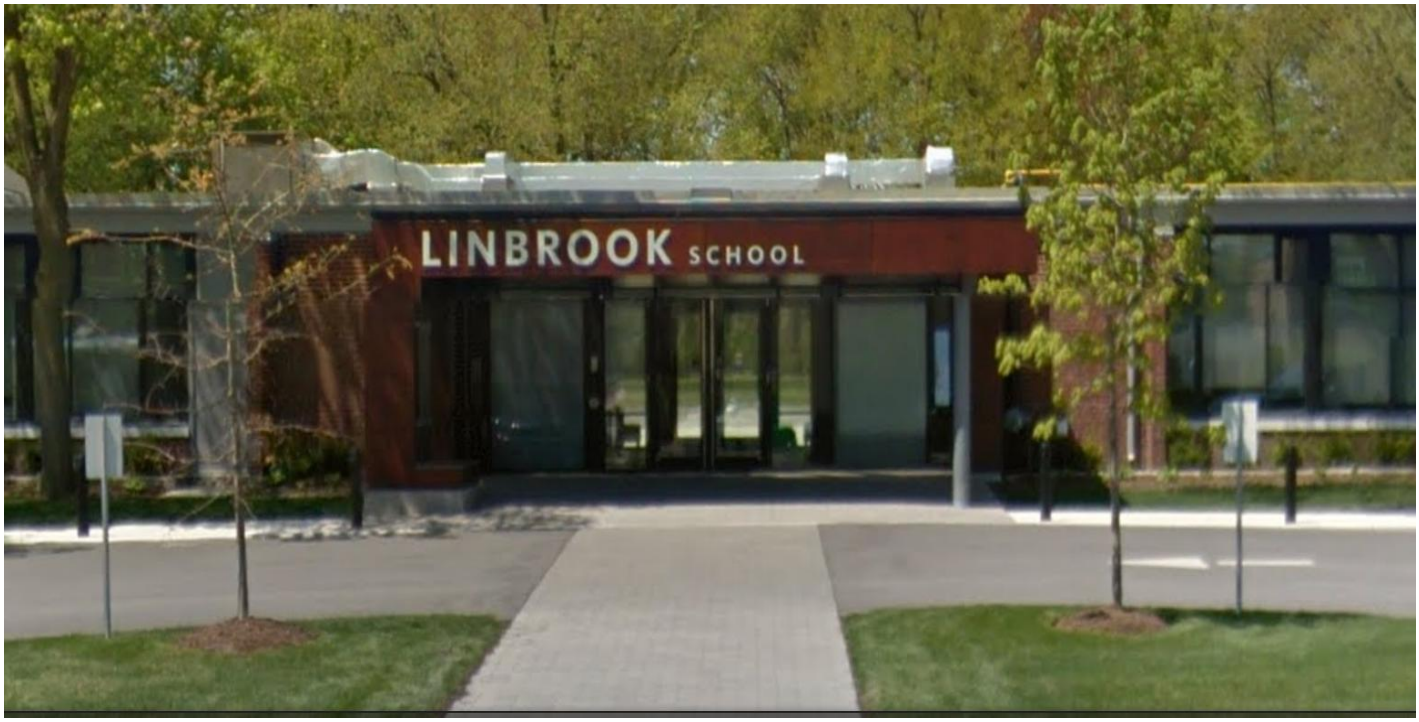
Test Location:

Linbrook School
Head of School: Amber Way
1079 Linbrook Road
Oakville, ON L6J 2L2
Canada

Technical Support Rep: Dan Whitfield

Lead Designer
AVI CONSULTING
289.259.5898
dan@avi-consulting.com

EMR Technician: Rob Metzinger - Electronics Engineering Technologist, BBEC, EMRS
Bryan Fromm - Electronics Engineering Technician
Testing Date: Sunday September 27th, 2015
Arrival on-site: 8:00 AM
Testing Time: 9:00 AM – 1:15 PM



Introduction

A request was made by Dan Whitfield, the technical support representative for Linbrook School, to have a Radio Frequency “RF” Radiation assessment conducted at the school in Oakville. Amber Way, the head of the school, was interested in acquiring the level of RF radiation the students were exposed to while in the classroom. The request included measuring the levels with WiFi active and with the WiFi shut down plus a baseline outside on the soccer field. Amber also wanted to measure the RF exposure in a classroom with multiple computers and Ipads accessing the WiFi network. Please see below for details.

Individual measurements were taken in 19 different locations throughout the school grounds, the first series of measurements with the Cisco Meraki MR 18 wireless network broadcasting normally. Additional testing was done in the Grade 1 Classroom using iPad Air tablets and the Grade 4 Classroom using MacBook Pro Retina laptops to simulate a typical classroom environment. The wireless network was then powered off and the 19 locations were re-measured to identify potential external sources entering the building.

Equipment Used:

Analyzer: Gigahertz Solutions HFE59B Radio Frequency Analyzer
Antenna: Gigahertz Solutions UBB27, broadband, omni-directional 27 MHz – 3.3 GHz

Analyzer: Gigahertz Solutions HFEW59D Radio Frequency Analyzer
Antenna: Gigahertz Solutions UBB2410, broadband, omni-directional 2.4GHz – 10 GHz

Analyzer: Gigahertz Solutions NFA1000 Data Logger and 3D AC Electric and AC Magnetic Field Analyzer

Analyzer: TTi PSA6005, 10MHz-6.0 GHz Spectrum Analyzer.

(See appendix A for more detail and calibration certificates)

Measurement Procedure

At each measurement location, the surveyor held the meter/antenna unit in his outstretch arm. The measurement at each location was done in during a period of 60 seconds. A minimum of 2 readings were taken at each location until 2 consistent measurements were obtained. (Within 25% of each other). The 2 readings were then averaged. The meter was cleared to zero before a measurement period was started. Extremely high and low readings were discarded. The position of the meter with the attached isotropic antenna started at about 20 cm from the ground then the meter was moved up slowly, stopped at about 2 metres then moved down again. The meter was rotated about its axis during the up-and-down movement while the surveyor rotated 360 degrees during a measurement period. This cycle was repeated as necessary to cover the required measuring periods. The measurements were recorded as the exposure values for that particular location. Such displacement of the meter theoretically represents the maximum exposure (peak) to the entire body of a person over a period of 60 seconds.

Radio Frequency Radiation (RFR) Exposure Table

RF Measurements: µW/m² (microwatts/square meter)
Signal Evaluated: Full Signal (Analogue and Digital Component)
Highest reading in 60 seconds of scanning

Location	HFE59B 27 MHz - 3.3 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFEW59D 2.4 GHz - 10 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFE59B 27 MHz - 3.3 GHz µW/m² (microwatts/sq. meter) WiFi OFF	HFEW59D 2.4 GHz - 10 GHz µW/m² (microwatts/sq. meter) WiFi OFF
Art Room	18,000	37,000	5-17	30
I.T Office	1100	15,000	500	150
S.K Classroom	15,000	23,000	73	7
J.K Classroom	16,000	28,000	81	115
Grade 2 Classroom	17,000	22,000	110	500
Grade 1 Classroom	26,000	50,000	200	0-3
Gymnasium	9000	9700	18	10
Grade 3 Classroom	27,000	30,000	22	22
Office Room 118 - Amber	2000	5000	150	300
Office Room 119 - Mike	31,000	33,000	28	5
Grade 4 Classroom	19,000	19,000	9	1
Grade 5 Classroom	17,000	23,000	53	15
Grade 6 Classroom	18,000	33,000	20	10
Grade 7 Classroom	15,000	22,000	37	18
Grade 8 Classroom	32,000	37,000	130	30
Library	2700	6000	9	2
Outside - near Park	650	130	750	150
Music Room	70	150	-	-
Gymnasium(On Stage)	1800	1500	19	5

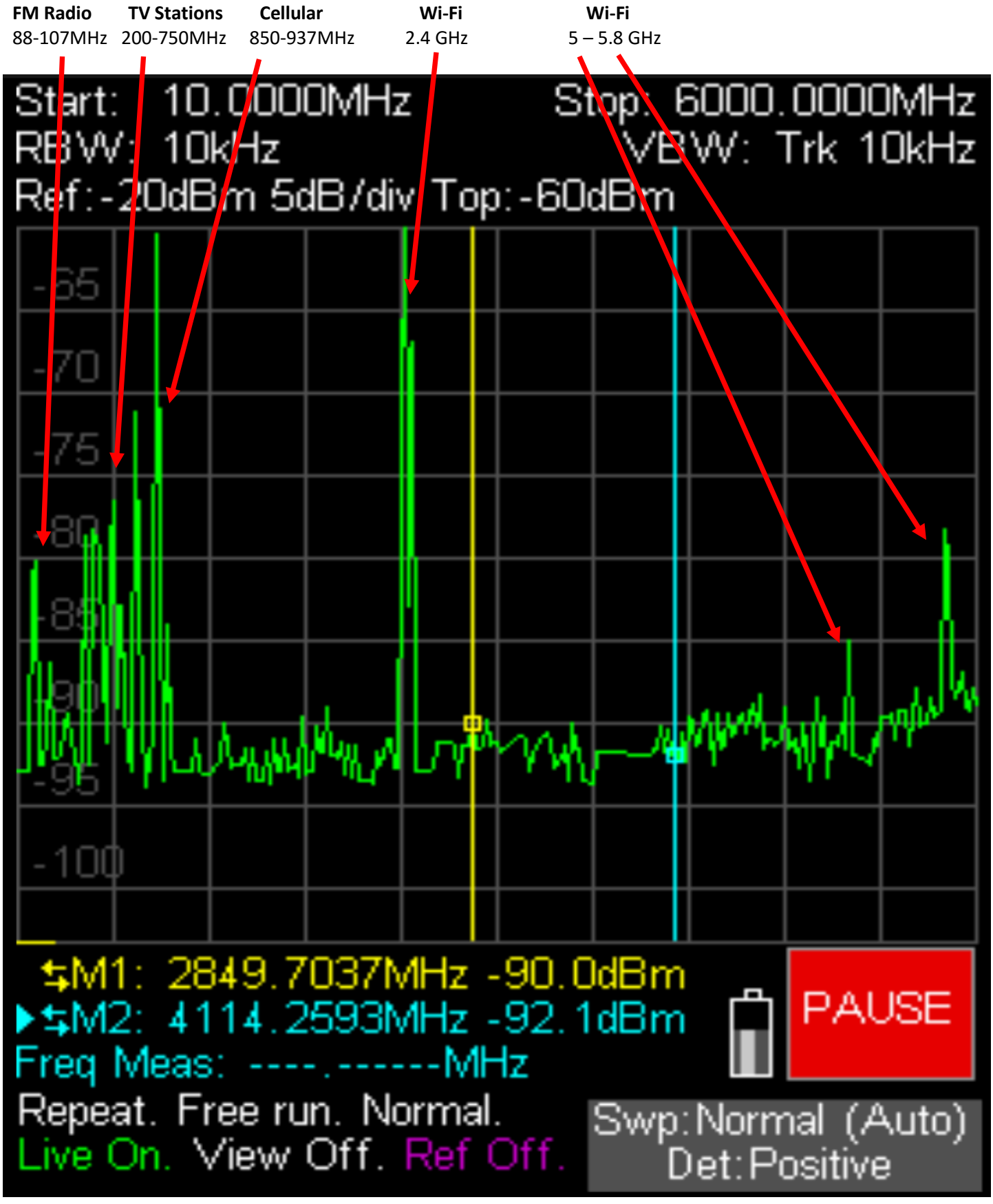
Apple PowerBooks Streaming Data - Spot Measurements (Grade 4)

HFE59B (27 MHz - 3.3 GHz) 6,700 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 57,000 µW/m²	**Front of Class**  **ACCESS POINT**	**HFE59B (27MHz-3.3GHz)** 5,700 µW/m² **HFEW59D 2.4GHz-10GHz** 100,000 µW/m² 
HFE59B (27 MHz - 3.3 GHz) 7,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 52,000 µW/m²	**Back Of Class**	**HFE59B (27 MHz - 3.3 GHz)** 4,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 85,000 µW/m²

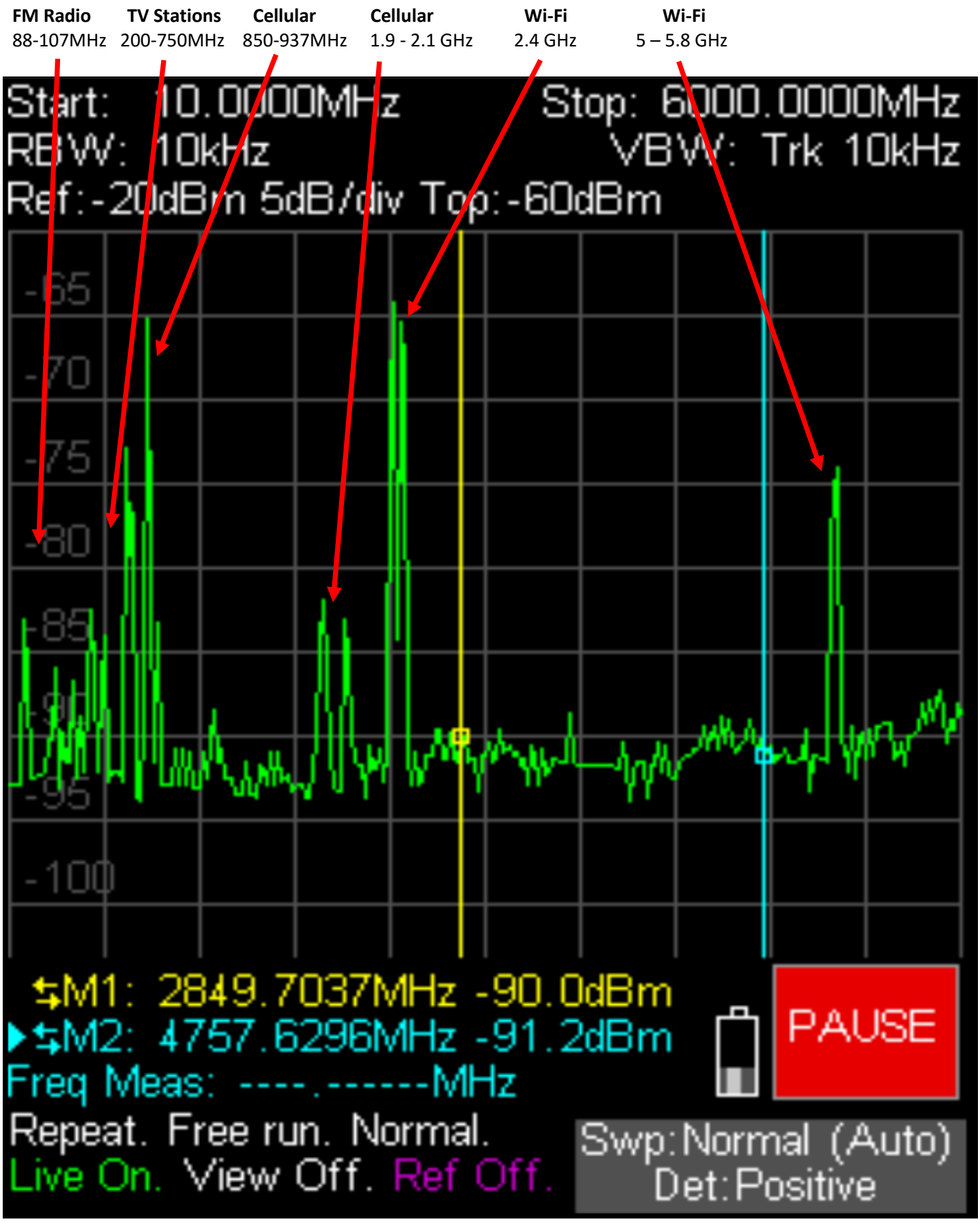
iPads Streaming Data - Spot Measurements (Grade 1)

 **HFE59B (27 MHz - 3.3 GHz)** 11,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 20,000 µW/m²	**Front Of Class**	**HFE59B (27 MHz - 3.3 GHz)** 37,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 47,000 µW/m²
	ACCESS POINT **Center of Class** 	
HFE59B (27 MHz - 3.3 GHz) 17,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 22,000 µW/m²	**Back of Class**	**HFE59B (27 MHz - 3.3 GHz)** 20,000 µW/m² **HFEW59D (2.4 GHz – 10 GHz)** 24,000 µW/m²

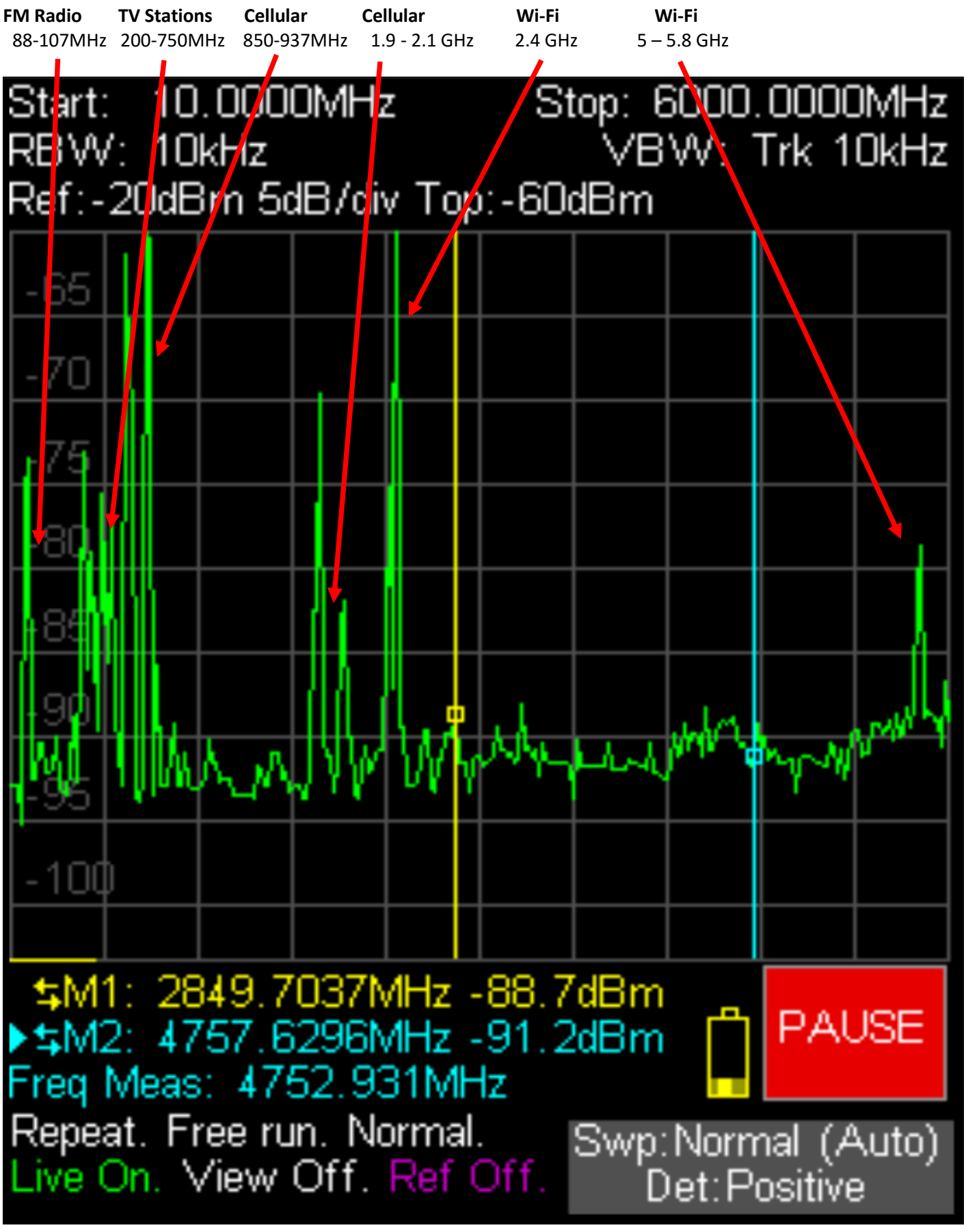
Spectrum Analyzer Images
Grade 1: WiFi On Background Levels



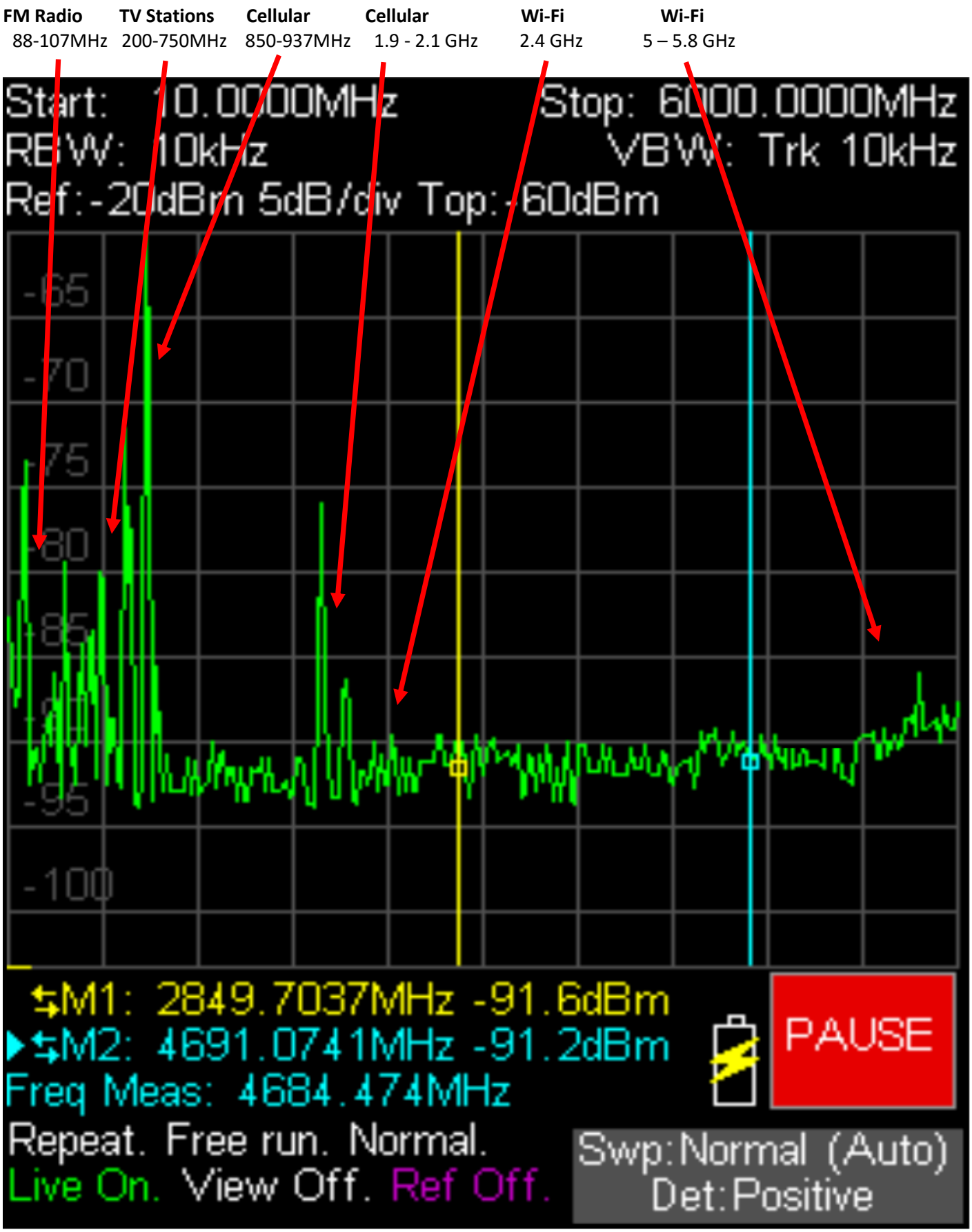
Grade 4: 17 Apple MacBook Pro Retina 15” Streaming Data



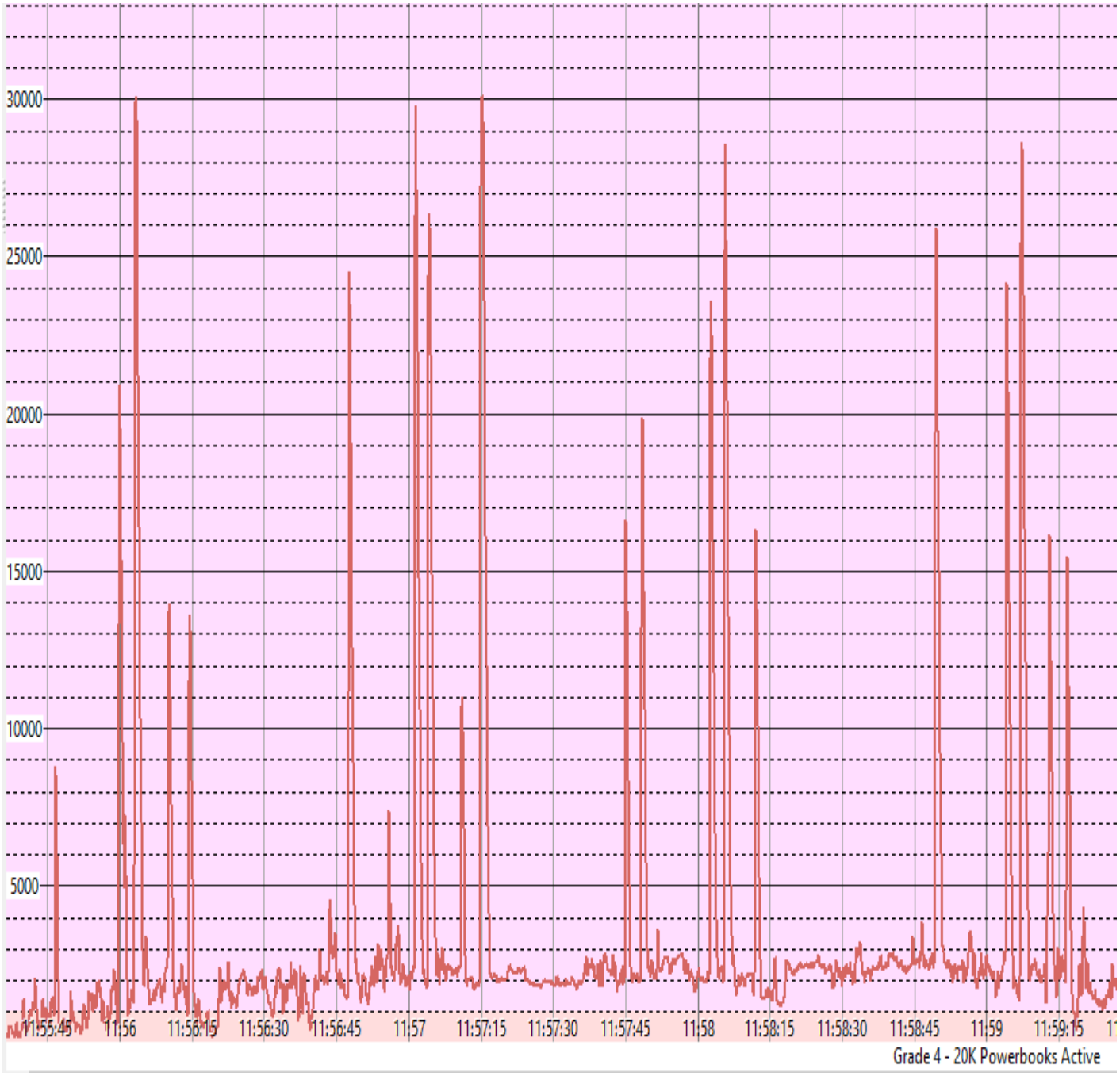
Grade 1: 15 iPad Air tablets Streaming Data



Grade 4: WiFi Off Background Levels



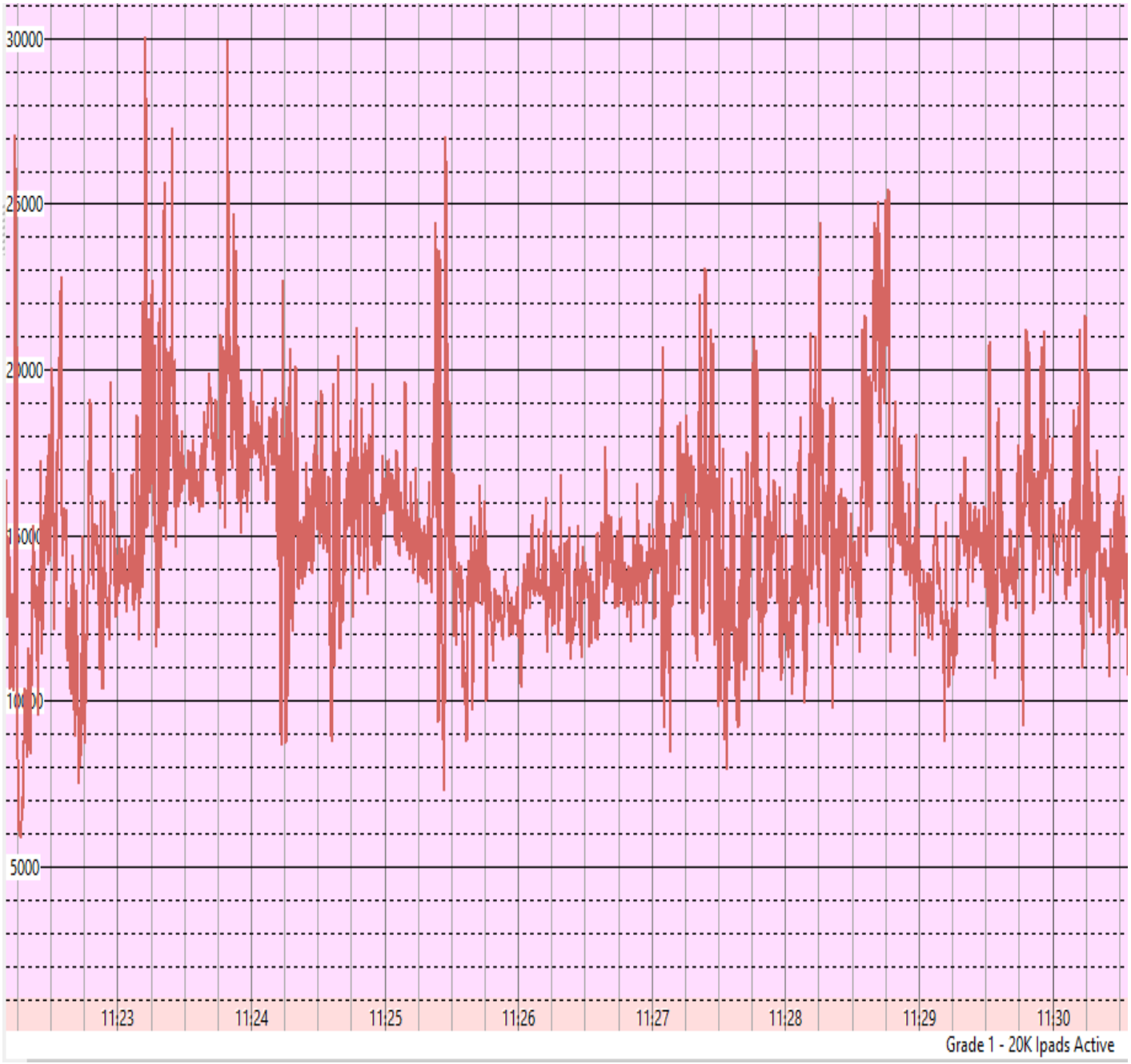
DataLogs: Grade 4: 17 Apple MacBook Pro Retina 15” Streaming Data



HF

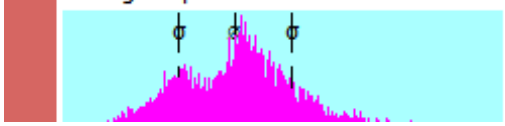
Minimum:	92.00 uW/m^2
Maximum:	29996.00 uW/m^2
Average:	3334.91 uW/m^2
S.-Deviation:	4619.14 uW/m^2
95th percentile:	14107.16 uW/m^2
Edges/h:	481.2 /h
Abs. threshold:	3334.00 uW/m^2
average of peaks:	15288.40 uW/m^2

Grade 1: 15 iPad Air tablets Streaming Data



HF

Minimum:	2494.00 uW/m^2
Maximum:	29994.00 uW/m^2
Average:	13203.02 uW/m^2
S.-Deviation:	3587.47 uW/m^2
95th percentile:	19035.35 uW/m^2
Edges/h:	1345.9 /h
Abs. threshold:	13911.06 uW/m^2
average of peaks:	15919.30 uW/m^2



RADIOFREQUENCY / MICROWAVE EXPOSURE GUIDELINES

(High Frequency Electromagnetic Waves)

1] BUILDING BIOLOGY PRECAUTIONARY GUIDELINES (SBM-2008) For Sleeping Areas

Power density in microwatt	**No Concern**	**Slight Concern**	**Severe Concern**	**Extreme Concern**
per square meter **µW/m²**	**< 0.1**	**0.1-10**	**10 - 1000**	**> 1000**
per square cm **µW/cm²**	**< 0.000,01**	**0.000,01 - 0.001**	**0.001 - 0.1**	**> 0.1**

2] BIOINITIATIVE REPORT PERCAUTIONARY GUIDELINES (2012)

Dr. Martin Blank - Columbia University Evidence of Biological Effects **3.4 - 700 µW/m²** or 0.00034 - 0.07 µW/cm²
http://www.bioinitiative.org/

BIOINITIATIVE REPORT PERCAUTIONARY GUIDELINES (2007)

Dr. Martin Blank - Columbia University Biologically Based Precautionary Levels **1,000 µW/m²** or 0.1 µW/cm²
http://www.bioinitiative.org/

3] CANADIAN GOVERNMENT GUIDELINES SAFETY CODE 6 (2015)

In Canada, guidelines for Radio Frequency Wave exposure lay under the jurisdiction of Health Canada. Safety code 6 was developed in 1999 and offers federal guidelines for safe RF exposure levels. These limits are in the range of **1,291,219 to 61,000,000 µW/m²** and are based solely on the short term thermal effects or the heating of body tissue.

Radio Frequency Risk Assessment

The main internal sources were network access points, Bluetooth keyboards and mice, laptops, iPads, and Laptops. Power density readings at all locations were below 2% of Industry Canada's Safety Code 6 Radio Frequency Exposure Guidelines. Safety Code 6 is based on thermal effects of microwave radiation on the body over an exposure time of 6 minutes, but does not take into account the biological health effects which can occur at much lower levels with long term exposure. The Bioinitiative Report is a collection of studies on the biological health effects of microwave radiation and it recommends a precautionary exposure limit of 1000 μW/m² for daily exposures. Our belief is that any attainable reduction in Radio Frequency radiation is worth pursuing. Measured values in the majority of the locations assessed are higher than this precautionary level.

Recommendations for Reducing Overall Exposure:

The main source of RF exposure in Linbrook School is the Wireless access points / Wi-Fi network. Over 99% in most classrooms based on power density measurements with Wi-Fi on and Wi-Fi off. Reducing this source can offer a significant reduction in overall RF exposure to the students and staff. See below for recommendation for reducing RF exposure, sorted in order of most to least impact.

1. Implement a wired solution such as wiring each device to dedicated network port and disabling all wireless features in the device. (Will not be practical in this case)

2. Most commercial routers / access points allow the user to adjust the RF transmission level of each access point. If the transmission power settings are at maximum levels, there may be an option to lower them and still achieve the desired coverage.

3. Move the location of the access points to the hallway to help lower overall RF exposure. A greater distance from the source equals lower RF exposure. Also, by placing the access points in the hallway, now there is a wall separating the students from the source which will offer and additional reduction of exposure.

4. Move the location of the access points to the corner / side of each room to help lower overall RF exposure. A greater distance from the source equals lower RF exposure.

5. Disable wireless networking on laptops and iPads by using airplane mode when they are not accessing the network and connect to Wi-Fi only as required.

6. Disable the wireless transmissions from Mac Mini's located in the computer cabinets as the Wi-Fi is being accessed through the cisco access points.

7. Replace Bluetooth keyboards and mice with a wired alternative.

Follow-up Visit:

EMR Technician: Bryan Fromm - Electronics Engineering Technician
Testing Date: Sunday February 7th, 2016
Arrival on-site: 9:00 AM
Testing Time: 9:10 AM – 11:00 AM

	Sunday September 27th, 2015		Sunday February 7th, 2016 Measurements in Center of Room		Sunday February 7th, 2016 Measurements at Seat Closest to Router		Measurement Location: Center of Room		Measurement Location: Closest Seat to Router	
Location	HFE59B 27 MHz - 3.3 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFEW59D 2.4 GHz - 10 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFE59B 27 MHz - 3.3 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFEW59D 2.4 GHz - 10 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFE59B 27 MHz - 3.3 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFEW59D 2.4 GHz - 10 GHz µW/m² (microwatts/sq. meter) WiFi ON	HFE59B Percent Reduction	HFEW59D Percent Reduction	HFE59B Percent Reduction	HFEW59D Percent Reduction
Art Room	18,000	37,000	1100	2200	2800	4600	93.89%	94.05%	84.44%	87.57%
I.T Office	1100	15,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S.K Classroom	15,000	23,000	450	750	2200	2500	97.00%	96.74%	85.33%	89.13%
J.K Classroom	16,000	28,000	470	470	1800	2200	97.06%	98.32%	88.75%	92.14%
Grade 2 Classroom	17,000	22,000	530	800	1600	950	96.88%	96.36%	90.59%	95.68%
Grade 1 Classroom	26,000	50,000	600	800	1700	1850	97.69%	98.40%	93.46%	96.30%
Gymnasium	9000	9700	175	121	470	430	98.06%	98.75%	94.78%	95.57%
Grade 3 Classroom	27,000	30,000	1270	1550	2500	2650	95.30%	94.83%	90.74%	91.17%
Office Room 118 - Amber	2000	5000	78	20	N/A	N/A	96.10%	99.60%	N/A	N/A
Office Room 119 - Mike	31,000	33,000	5000	4300	N/A	N/A	83.87%	86.97%	N/A	N/A
Grade 4 Classroom	19,000	19,000	4300	2700	2300	1700	77.37%	85.79%	87.89%	91.05%
Grade 5 Classroom	17,000	23,000	440	600	3100	3100	97.41%	97.39%	81.76%	86.52%
Grade 6 Classroom	18,000	33,000	370	580	1000	1400	97.94%	98.24%	94.44%	95.76%
Grade 7 Classroom	15,000	22,000	500	350	780	1000	96.67%	98.41%	94.80%	95.45%
Grade 8 Classroom	32,000	37,000	500	1440	1360	1800	98.44%	96.11%	95.75%	95.14%
Library	2700	6000	1440	1590	1440	1590	46.67%	73.50%	46.67%	73.50%
Outside - near Park	650	130	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Music Room	70	150	189	73	N/A	N/A	-170.00%	51.33%	N/A	N/A
Gymnasium(On Stage)	1800	1500	20	77	20	77	98.89%	94.87%	98.89%	94.89%

Summary of Findings:

Since our September 27th visit, the routers in each classroom were re-located from the center of the majority of the classrooms to a corner of the classroom. In some cases, relocation was not possible. Each router also had the power output reduced through network settings. Measurements after the changes were taken in two locations in each classroom, one in the center of the classroom where the routers were located previously and the other at the closest seat to the new location of the router. In each classroom reductions were recorded between 81% and 98%. The majority of classrooms in the center of the room are now below the building biology precautionary level of 1000 µW/m² and less than 1% of Canadian Safety Code 6 regulations.

Rob Metzinger,

Electronics Engineering Technologist, BBEC, EMRS
President, Safe Living Technologies Inc.

Bryan Fromm,

Electronics Engineering Technician
Sr. EMR Technician, Safe Living Technologies Inc.

Technical Support

Once you have received the written component of your EMR Home Assessment we encourage you to take advantage of our offer to have 15 minutes of free telephone consultation with an EMR technician. It is an opportunity to review the assessment and have any questions you might have answered. It is important to us that you understand the information we have provided you with and that our mitigation recommendations are accessible to you and your family. Please contact us either by phone or e-mail to set up a consultation time.

Privacy

The information in this report is confidential and will not be shared with anyone except the Client. The results relate only to the items tested.

Disclaimer / Legal

Though we hope the included recommendations will lead to a healthier life, Safe Living Technologies Inc., and its representatives shall have no liability with respect to the recommendations made, actions taken or courses of conduct implemented based on the results. Safe Living Technologies Inc. shall not be liable with respect to the test results for incidental or consequential damages, lost profits or revenues to the fullest extent such liability may be disclaimed by law. In no event shall Safe Living Technologies Inc. liability exceed the amount paid to Safe Living Technologies by the client. The results relate only to the items tested. The discussions in this report are based only on single (one time) results and may not be repeatable if conditions in the home change or if the results are collected during a different period of time.

Copyright

Appendix A:

Equipment Used:

Meter: Broadband RF Analyzer - Gigahertz Solutions eHFE59B – Displays Power Density
Values displayed are the sum of all of the RFR sources in the band of the antenna
Antenna: UBB27 Broadband Isotropic – 27 MHz – 3.3 GHz

A note regarding the UBB27 Broadband Isotropic antenna: For this survey, the HF59B with the UBB27 Isotropic antenna was used. The UBB27 measurement antenna is a far field antenna which requires that the antenna be located at least 1 wavelength preferably 2-3 from the source.

The HF59B RF Analyzer, shown below possesses these main features:

- Isotropic tri-axial power density antenna “3D”
- Meter displays instantaneous and "maximum hold" values
- Measures power density in µW/m² (microwatts per Square meter)
- UBB27 Isotropic antenna covers 27MHz to 3.3 GHz
- Uncertainty +/- 3 dB meaning (+100% - 50%)

Meter Used for Assessment

Meter Calibration:

3rd Party Calibration: Performed by Steep GmbH Germany, according to the standards of DIN EN ISO/EC 17025 and ISO9001

Factory Calibration:
Calibrated in factory by Gigahertz Solutions. Professional Laboratory measurement equipment was used from Anritsu, Rohde & Schwarz and IFR (former Marconi) using the internationally accepted “Absolute –Method” for the antenna. The final test prior to dispatch proved that it conforms to its specifications in every respect.

Meter Serial Number: 053000022727
Antenna Serial Number: 053030022668
Meter and Antenna Calibration Date: June 13, 2013
Serco Calibration Certificate Number: K0-0313-2013-06

Figure A-1: Gigahertz Solutions, HF59B with UBB27 Isotropic Antenna

Measurement Uncertainty:

Every measurement is subject to uncertainties. Any official measurement report can only be considered to be complete when it includes the measurement uncertainties as well as the measurement results. Every factor that may influence the measurement result must be taken into account. The uncertainty associated with each of these factors also needs to be estimated. Generally, there are two possible sources of uncertainty or error: the measuring equipment and the person operating it.

The specified values:

The Manufacturer of the meter, Gigahertz Solutions, calculates the maximum measurement uncertainty at +/- 3dB which means the measurement result can be up to 100% above the measured value or 50% below. This is the worst case scenario and must be taken into account. This may seem high but it is one of the best uncertainty values for RFR test equipment on the market today.

Unit of Measurement: Power Density in µW/m² (microwatts per square meter) or mW/m² (milliwatts per square meter).

Calibration Certificate HF59B and UBB27 Antenna:

steep GmbH ♦ Lise-Meitner-Straße 6 ♦ D-85521 Ottobrunn

Kalibrierschein
Calibration Certificate

Kalibrierzeichen
Calibration mark

K0-0313-2013-06

Gegenstand *Object*	**HF-Analyser mit Ultra-Breitband-Antenne**
Hersteller *Manufacturer*	**Gigahertz Solutions GmbH**
Typ *Type*	**HF-Analyser: HF 59B** **Antenne: UBB27_G3**
Fabrikate/Serien-Nr. *Serial number*	**HF-Analyser: 053000022727** **Antenne: 053030022668**
Auftraggeber *Customer*	**Gigahertz Solutions GmbH** **Am Galgenberg 12** **D-90579 Langenzenn**
Auftragsnummer *Order No.*	**K0-13004**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**5**
Datum der Kalibrierung *Date of calibration*	**13.06.2013**

Die Kalibrierung erfolgt durch Vergleich mit Bezugsnormalen bzw. Bezugsnormalmess-einrichtungen, die in einer Kalibrierstelle des Deutschen Kalibrierdienstes (DKD) kalibriert und damit rückgeführt sind auf die nationalen Normale, mit denen die Physikalisch-Technische Bundesanstalt (PTB) die physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI) darstellt.

Die Kalibrierung erfolgte in Übereinstimmung mit den Normen DIN EN ISO/IEC 17025 und ISO 9001.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

The calibration is performed by comparison with reference standards or standard measuring equipment which are calibrated by a Calibration laboratory of the Deutscher Kalibrierdienst (DKD) and thus traceable to the national measurement standards maintained by the Physikalisch-Technische Bundesanstalt (PTB) for the realization of the physical units according to the International system of Units (SI).

The calibration is performed according to the standards DIN EN ISO/IEC 17025 and ISO 9001.

The user is obliged to have the object recalibrated at appropiate intervals

Die angegebenen Meßwerte gelten zum Zeitpunkt der Kalibrierung. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.
The measured values are valid for the moment of calibration. Calibration certificates without signature are not valid.

Stempel *Seal*	Datum *Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
steep GmbH EMV-Zentrum Ottobrunn Lise-Meitner-Strasse 6 D-85521 Ottobrunn	21.06.2013	Frank Rittmann	Manfred Rummer

Tel.: +49 (0) 89 4449-1700, Fax.: +49 (0) 89 4449-24165, E-mail: Kalibrierlabor@steep.de

Analyzer: Gigahertz Solutions 3D, AC Electric and AC Magnetic Field Analyzer NFA1000 **Frequency Range:** 5Hz – 1 MHz

The NFA1000 EMF Analyzer / Data Logger, shown below possesses these main features:

- Records simultaneously on 4 recording channels (CH1-3) for desired 3D measurement and optional channel 4 for Radio Frequency Data logging
- Frequency Range 5Hz – 1,000,000 Hz
- 3D potential-free electric field measurement
- 3D measurement of the magnetic field
- Ability for extensive long-term data recordings
- Accuracy better than +/- 2 dB

Meter Used for Assessment

Meter Calibration:

3rd Party Calibration: Performed by Steep GmbH Germany, according to the standards of DIN EN ISO/EC 17025 and ISO9001

Factory Calibration:
Calibrated in factory by Gigahertz Solutions. Professional Laboratory measurement equipment was used from Anritsu, Rohde & Schwarz and IFR (former Marconi) using the internationally accepted “Absolute –Method” for the antenna. The final test prior to dispatch proved that it conforms to its specifications in every respect.

Meter Serial Number: 035000000848
Meter Calibration Date: June 12, 2013
Steep Calibration Certificate Number: K0-0312-2013-06

Calibration Certificate - NFA1000

steep GmbH ♦ Lise-Meitner-Straße 6 ♦ D-85521 Ottobrunn

Kalibrierschein
Calibration Certificate

Kalibrierzeichen
Calibration mark

K0-0312-2013-06

Gegenstand *Object*	**3D-NF-Analyser**
Hersteller *Manufacturer*	**Gigahertz Solutions GmbH**
Typ *Type*	**NFA 1000**
Fabrikate/Serien-Nr. *Serial number*	**035000000848**
Auftraggeber *Customer*	**Gigahertz Solutions GmbH** **Am Galgenberg 12** **D-90579 Langenzenn**
Auftragsnummer *Order No.*	**K0-13004**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**5**
Datum der Kalibrierung *Date of calibration*	**12.06.2013**

Die Kalibrierung erfolgt durch Vergleich mit Bezugsnormalen bzw. Bezugsnormalmess-einrichtungen, die in einer Kalibrierstelle des Deutschen Kalibrierdienstes (DKD) kalibriert und damit rückgeführt sind auf die nationalen Normale; mit denen die Physikalisch-Technische Bundesanstalt (PTB) die physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI) darstellt.

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Die angegebenen Meßwerte gelten zum Zeitpunkt der Kalibrierung. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.
The measured values are valid for the moment of calibration. Calibration certificates without signature are not valid.

Stempel *Seal*	Datum *Date*	Stellv. Leiter des Kalibrierlaboratoriums *Deputy Head of the calibration laboratory*	Bearbeiter *Person in charge*
steep GmbH EMV-Zentrum Ottobrunn Lise-Meitner-Strasse 6 D-85521 Ottobrunn	21.06.2013	Frank Rittmann	Manfred Rummer

Tel.: +49 (0) 89 4449-1700, Fax.: +49 (0) 89 4449-24165, E-mail: Kalibrierlabor@steep.de

Analyzer: Gigahertz Solutions HFEW59D Radio Frequency Analyzer
Antenna: Gigahertz Solutions UBB2410, broadband, omni-directional 2.4GHz – 10 GHz

A note regarding the UBB24-10 Broadband Isotropic antenna: For this survey, the HFEW59D with the UBB24-10 Isotropic antenna was used. The UBB24-10 measurement antenna is a far field antenna which requires that the antenna be located at least 1 wavelength preferably 2-3 from the source.

Serial Number: 28926 **Date of Manufacture** – Aug 2015.


GIGAHERTZ SOLUTIONS
Made in Germany

CERTIFICATE
OF CALIBRATION

Gigahertz Solutions GmbH hereby certifies that this instrument for measuring alternating fields was calibrated during the manufacturing process.

Gigahertz Solutions GmbH further certifies that the laboratory instrumentation used to prove this instrument´s quality have been calibrated to a laboratory standard directly traceable to the German "Physikalisch-Technische Bundesanstalt", the National Institute of Standards, or natural physical constants at planned intervals.

Gigahertz Solutions´ "Total Quality" System is monitored by VDE, the German Association for Electrical, Electronic & Information Technologies to assure the compliance of the manufactured products to published specifications, especially for the safety of the produced demand switches.

Quality Assurance Representative

Gigahertz Solutions GmbH, Am Galgenberg 12, 90579 Langenzenn, Germany

Frequency Range of Meter:	2.4 GHz to 10 GHz
Measurement Range 1:	Min: 1 – 1999 µW/m²
Measurement Range 2:	Max: 0.01 – 19.99 mW/m²
Measurement Range 3: (with HV20)	Min: 0.01 – 19.99 µW/m²
Measurement Range 4: (with HV20)	Max: 0.1 – 199.9 µW/m²
Attenuation:	Modules available to extend the scales in increments of 20db
Antenna:	Standard True Logarithmic Periodic Antenna 2.4 GHz – 10 GHz
Antenna:	(Sold Separately or in the HFEW59D RF Meter Kit) Ultra Broadband Omni-Directional Antenna (UBB2410) 2.4 GHz to 10 GHz
Audio Analysis:	Identification of pulsed radiation sources (WLAN, WiFi, air-traffic control radar, etc)
Outputs:	AC (demodulated signal, calibrated) and scalable DC output
Signal Evaluation:	True Peak and average
Accuracy:	+ / – 4.5 dB
Linearity Deviation:	+ / – 4.5 dB
Rollover:	+ / – 5 digits
Power:	9.6 V NiMH battery pack and power supply included
Weight:	Approx. 1.25 kg
Material of Case:	Plastic

PSA Series 5 RF Spectrum Analyzers

Bench-top performance handheld convenience

PSA3605 - 3.6GHz
PSA6005 - 6.0GHz

The PSA Series 5 is the latest and highest performance true handheld RF spectrum analyzer from Aim-TTi.

It complements the existing PSA Series 2 by offering a significantly expanded feature set similar to that found on analyzers costing several times as much, combined with a frequency capability up to 6 GHz.

Genuinely hand-held

The PSA Series 5 is sufficiently small and lightweight to fit comfortably into the hand - unlike most other so-called handheld spectrum analyzers.

A removable screen protector and sun-shield combines with rubberised buffers top and bottom to enhance its use in the field.

High resolution colour display

The 4.3" TFT display provides a wealth of detailed information. Colour is used to clearly distinguish between multiple traces, markers and limit lines.

The touch-screen uses a three row hierarchical menu system to provide fast and intuitive control of the many functions.

Battery operation of more than three hours

The PSA Series 5 operates from a Li-ion rechargeable battery that can provide more than three hours of continuous operation.

If switched off to conserve power, it returns to normal operation within a few seconds of switch-on with all data retained. It can also be set to switch off automatically after a set time from the last action.

For continuous bench top operation it can be powered from its AC adaptor which also recharges the batteries in less than 3 hours.

Unlimited data storage

With nearly 2GB of internal memory, the PSA Series 5 can store thousands of waveforms, instrument set-ups, or complete screen images.

With option U02 installed, it can also log tens of thousands of results and make use of compensation tables and limit patterns.

All files can be saved with either default file names or with user defined names using the alpha-numeric keypad.

USB Flash drives can be used to copy and backup data, or transfer it to a PC for analysis. Alternatively a USB device interface is included for direct connection to a PC for file transfer.

A big feature set in a small instrument

The PSA Series 5 incorporates bench-top level features within in a portable spectrum analyzer.

- 10MHz to 3600MHz or 6000MHz frequency range
- Resolution bandwidths from 300Hz to 10MHz (1:3:10)
- <-120dBm noise floor at -40dBm ref. level and 10kHz RBW (better than -160 dBm per Hz)
- Measurement in dBm or dBµV, mV or µW
- Zero span mode with AM and FM audio demodulation
- Trace modes of normal, peak hold and trace average
- Live, View and Reference traces in contrasting colours
- Twin markers with readout of absolute & difference values
- Smart marker movement with selectable peak tracking
- Frequency counter with down to 10Hz resolution
- Frequency presets and independent state storage
- Auto-find automatically sets sweep parameters for the highest signal found
- Unlimited storage for waveforms, set-ups and screens
- User assignable file names, file stamping from real-time clock
- USB interfaces for Flash drives and PC connection
- Comprehensive status and context sensitive help screens
- True handheld size with weight of just 560 grams (20oz)

Option U02 additional features include:

- Limit lines and limit patterns with limits comparator
- Data logging of peak values, complete traces or screen images from timer, external trigger or limits comparator
- Automatic Measurements for CP, ACPR and OBW
- Waveform demodulation for AM and FM/PM signals
- Compensation tables, fixed offsets and 75Ω compensation

Appendix B

Exposure Guidelines: Canada's Safety Code 6 (SC6):

Radio wave radiation will heat body tissue. Safety Code 6 was implemented in 1999 and is based on the negative effects of the short term heating effects of body tissue. This is referred to as the thermal effect of RF radiation. Federal regulators are continuing to study the effects of long term low level exposures to this form of radiation.

The following is taken from:

Health Canada. "Environmental and Workplace Health". Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz – Safety Code 6, 2015.

http://www.hc-sc.gc.ca/ewh-semt/consult/_2014/safety_code_6-code_securite_6/final_finale-eng.php

Safety Code 6 as of 2015

2.2.2. Electric Field Strength, Magnetic Field Strength and Power Density (10 MHz - 300 GHz)

To ensure compliance with the basic restrictions outlined in Section 2.1, at frequencies between 10 MHz and 300 GHz, the reference levels for electric- and magnetic-field strength and power density must be complied with.

Table 5. Reference Levels for Electric Field Strength, Magnetic Field Strength and Power Density in Uncontrolled Environments

Frequency (MHz)	Electric Field Strength (E_{RL}), (V/m, RMS)	Magnetic Field Strength (H_{RL}), (A/m, RMS)	Power Density (S_{RL}), (W/m^2)	Reference Period (minutes)
10 - 20	27.46	0.0728	2	6
20 - 48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48 - 300	22.06	0.05852	1.291	6
300 - 6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619\ f^{0.6834}$	6
6000 -15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	$616000 / f^{1.2}$
150000 - 300000	$0.158\ f^{0.5}$	$4.21\times10\text{-}4\ f^{0.5}$	$6.67\times10\text{-}5\ f$	$616000 / f^{1.2}$
Frequency, f, is in MHz.				

SAFE LIVING Technologies Inc.

Creating Healthy Living Spaces

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support@slt.co › www.slt.co

International Radio Frequency "RF" Exposure Limits for 1800 MHz Range

(Cell Phone, WiFi, Smart Meters, etc)

Location	Reference	Exposure time	Limit Based On	Lower by	µW/m2	V/m
Most of Western Europe	IEEE C95.1-1999 and ICNIRP	30 minutes	Thermal / Heating	-	10,000,000	61.4
USA	(FCC) IEEE C95.1-1999 and ICNIRP	30 minutes	Thermal / Heating	-	10,000,000	61.4
Canada	Safety Code 6, Table 5 (2015)	6 minutes	Thermal / Heating	66 x	4,393,278.4	40.7
Russia	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100 x	100,000	6.14
China	UDC 614.898.5 GB 9175 –88	3 hours +	Biological Effects	100 x	100,000	6.14
Italy	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100 x	100,000	6.14
Most of Eastern Europe	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100 x	100,000	6.14
Switzerland	Ordinance on Protection from Non-ionising Radiation (NISV)	Long Term	Precautionary	100 x	100,000	6.14
Toronto Board of Health, Canada	Proposed 1999	Long Term	Precautionary	100 x	100,000	6.14
Bio-Initiative Report recommendation	Bio-Initiative Report 2007	Long Term	Biological / Precautionary	10,000 x	1,000	0.614
Salzburg Resolution on Mobile Telecommunication	Preventive public health protection, Salzburg, June 7-8, 2000	Long Term	Precautionary	10,000 x	1,000	0.614
European Parliament	Resolution 1815, Strasburg, May 27, 2011	Long Term	Precautionary	10,000 x	106	0.2
Building Biology Guidelines Germany (Sleeping Areas)	SBM2008 - Level of No Biological Concern	Long Term	Precautionary	100,000,000 x	0.1	0.006,14
Cell Phone Operational Requirements				10,000,000,000 x	0.001	0.000,061,4
Natural Cosmic Radiation	MAES 2000	Long Term	Natural Exposure	10,000,000,000,000 x	0.000,001	0.000,000,061,4
Average Indoor Urban Exposure Toronto, Canada	Safe Living Technologies Inc. 2011	Long Term			200 - 5000	0.3 - 1.4

Electromagnetic Hypersensitivity or Electrical Sensitivity

Technology is changing at a staggering pace. We are now exposed to forces and energies that did not exist decades ago. Many new diseases and sicknesses have developed since our parent's generation including Electromagnetic Hypersensitivity "EHS" and new types of cancer. Both may have links to long term, low level, exposure to Electromagnetic fields "EMF" and radio-frequency waves "RF". EMF is a manmade pollutant that consists of AC Electric Fields and AC Magnetic Fields. It is produced from live electrical wiring, electric appliances and electronic devices. RF waves are produced by all wireless communication products.

Symptoms of EHS

Neurological: headaches, dizziness, nausea, difficulty concentrating, memory loss, irritability, depression, anxiety, insomnia, fatigue, weakness, tremors, muscle spasms, numbness, tingling, altered reflexes, muscle and joint paint, leg/foot pain, "Flu-like" symptoms, fever. More severe reactions can include seizures, paralysis, psychosis and stroke.
Cardiac: palpitations, arrhythmias, pain or pressure in the chest, low or high blood pressure, slow or fast heart rate, shortness of breath.
Respiratory: sinusitis, bronchitis, pneumonia, asthma.

Dermatological: skin rash, itching, burning, facial flushing.

Ophthalmologic: pain or burning in the eyes, pressure in/behind the eyes, deteriorating vision, floaters, cataracts.
Others: digestive problems, abdominal pain, enlarged thyroid, testicular/ovarian pain, dryness of lips, tongue, mouth, eyes, great thirst, dehydration, nosebleeds, internal bleeding, altered sugar metabolism, immune abnormalities, redistribution of metals within the body, hair loss, pain in the teeth, deteriorating fillings, impaired sense of smell, ringing in the ears, sensitivity to sounds and light, infertility

Long Term Health Effects

Adult cancer, tumours, childhood leukemia, breast cancer, DNA strand breakage, abnormal cell division, nerve damage, MS, ALS, Alzheimer and Parkinson disease, brain damage, melatonin reduction, miscarriages.

Prognosis

The severity of the symptom usually indicated the degree or stage of EHS. The stages vary from slight discomfort to debilitating long term effects. Once diagnosed, the complete elimination of electromagnetic radiation is necessary for relief. Recovery is possible but requires fortification of the immune system. This has proven to be a multi-step process unique to each individual and assistance from medical professional (Naturopathic or Environmental Doctor) is suggested.