Model SAM-Lite
Instruction Manual

Princeton Gamma-Tech Instruments
303C College Road East
Princeton, NJ 08540, USA
Tel: (609) 924 7310
Fax: (609) 924 1729
www.pgt.com

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1 Introduction

The PGT SAM-Lite is an easy-to-use portable radio-isotope identification (RID) system that detects and identifies multiple nuclides, providing quantified results using time-slice analysis. It is designed to be easily carried on a belt or in a pocket, and can be readily used by non-technical workers (such as emergency responders) with minimal training.

Figure 1 - The PGT SAM-Lite

It takes just a few minutes to learn how to use SAM-Lite. SAM-Lite features an easy-to-use three-button control system and easy-to-understand display.

Figure 2 - PGT SAM-Lite Screen and Control Buttons

If you are operating SAM-Lite for the first time, you may also want to look at the companion **Quick Start Guide**, which will get you up and running as quickly as possible. This **Instruction Manual** is intended as a reference guide, with more detailed information you may need if questions come up.

1.1 Basic Operation Features

SAM-Lite has two modes of operation:

In **Search** mode it is constantly taking measurements, and will alert you if an elevated reading of radioactive radiation is detected.

In **Collect Data** mode, a suspicious item or area can be measured, and these readings are recorded.

The device powers up in Search mode. The instrument has a simple, easy-to-learn user interface (described in Section 1.6.)

1.2 Advanced Operation Features

Advanced features of SAM-Lite include the ability to wirelessly communicate with a PC for more detailed display and analysis of readings, and the ability for a central administrator to keep track of and analyze readings from large numbers of SAM-Lite units in the field.

The PGT SAM-Lite can be connected to a remote computer using a wireless DigiMesh connection. Optional DigiMesh USB dongle and SLReader software provides connectivity to the PC. The data from PGT SAM-Lite can be accessed with either Quantum™ MCA (standard) or Quantum™ Gold (quantitative analysis) software.

The Quantum™ software facilitates analysis in 256-channel QCC mode. QCC is Quadratic Compression Conversion™. It is PGT's patented signal processing technique that delivers spectra with uniform channel peak widths.

See Section 4 for more information about available software, and Appendix Section 5.1 for instructions on connecting the PGT SAM-Lite to your computer.

1.3 About Your PGT SAM-Lite

Included with PGT SAM-Lite:

- The SAM-Lite spectrometer electronics
- A pre-installed lithium-ion battery (factory serviceable)
- An AC power adapter/battery charger

Optional accessories:

- XStick USB dongle adapter with SLReader PC communication software and DigiMesh wireless networking
- Quantum software
- A car power adapter

1.4 Typographic Conventions

This manual uses the following typographic conventions:

LEFT, ENTER	Keypad key names are shown in small capital letters.
`E:\spectra`	File or path names will be shown in typewriter font. Your PC drive letter may be different; we will use `E:` by default.
Warning, WARNING	Important notes are highlighted in italics.

1.5 Quick Start

Getting Started

Follow these instructions to quickly begin using SAM-Lite. You may start using SAM-Lite directly out of the box, with no additional preparations needed. SAM-Lite comes with a pre-charged, pre-installed battery sealed within the unit. SAM-Lite has also been factory calibrated.

1.5.1 About the Battery

The pre-charged battery should have enough power for you to try out SAM-Lite and learn how to use it before requiring recharging. It should last for several hours, however it is not fully charged.

The recommended charging time is 2 hours. The charger automatically shuts off after the battery is fully charged, to prevent damage from over-charging. (See Section 2.2 for more info about the battery.)

1.5.2 Powering On

Turn on the PGT SAM-Lite by briefly pressing the center ENTER key. A logo screen appears for a couple of seconds while the unit initializes, and then the main Dial Screen appears.

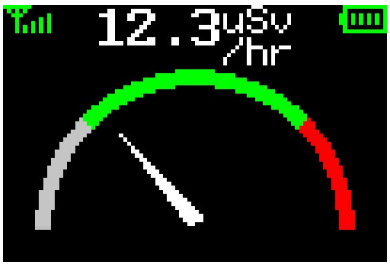

Figure 3 - PGT SAM-Lite Dial Screen

The instrument is ready for use when the Dial Screen appears. Battery status is continuously displayed in the upper right corner of this Dial Screen.

1.5.3 Powering Off

Turn off the PGT SAM-Lite by pressing and holding down the ENTER button for at least three seconds.

1.5.4 Basic Operation: Search and Collect Data

There are two main modes for measuring radioactivity:

- **Search** mode (**Auto-Collection**), functions as an alarm that alerts you when an increase in radioactivity is detected.
- **Collect Data** mode is used to take and record readings about a specific object or place.

Search Mode:

When the Dial Screen appears, the unit is in Search mode, which is the default. SAM-Lite is continuously monitoring for radioactivity. The Dial gives radioactive count rate information in the form of a speedometer. When radioactive material gives an indication in the green region this

signals proper source intensity for identification. The other colored regions indicate that the source is too far (grey) or too close (red).

Important: When the Dial is in the red zone the radioactivity level is dangerously high, and you should get away immediately!

An audible beep will be heard with increasing frequency as radioactivity levels increase. Note that a beep or two approximately every half hour is considered a normal background level.

Above the Dial, the unit also provides a numeric display of the radioactivity measurement converted to Seiverts (providing a basis for comparing threats to human health from various radioactive sources—see Appendix for more info about the Seivert radioactivity measurement system.)

Collect Data:

Press ⏻ ENTER button briefly while in Search mode to launch **Collect Data** mode. The SAM-Lite will collect, report, and store an analysis of a possible radioactive substance.

1.5.5 Basic Operation: Review Mode

Review Mode lets you view the dose rate and confidence of each isotope identified as elevated in the collection. Press the ⬅ LEFT button to launch Review mode.

See Section 3 - General Operation for more detailed information about these procedures.

1.6 Description of Keypad

Figure 4 shows a rendering of the PGT SAM-Lite keypad. The keypad has been designed to be extremely easy to use, so that it may be operated with the thumb of the same hand holding the instrument, and is accessible to people wearing protective gear as well as to both left and right-handed users.

Figure 4 - PGT SAM-Lite Keypad

Here is a brief description of the keys and how they are used:

⏻ ENTER	Used to select currently highlighted option, or to continue to next step of multi-step processes. This key is also used to turn system power on and off.
⬅ and ➡	These keys will be referred to as ⬅ LEFT and ➡RIGHT. They are used to scroll through and select a reading for review, or to select among items in a set of measurements, or to make other selections.

By pressing the ⬅ LEFT and ➡ RIGHT keys, you can move the highlighting on the SAM-Lite screen. Pressing the ENTER key will perform the action or make the selection specified by the currently highlighted item.

1.7 Self Test

When the PGT SAM-Lite is first powered on it performs an initial power-on self-test, or "POST." When the unit is functioning properly this occurs very quickly in the background. If the self-test determines there's a problem, a message will display along the bottom of the screen. If you see any message here upon powering up, or subsequently, please bring the unit to the attention of your supervisor, or your PGT dealer.

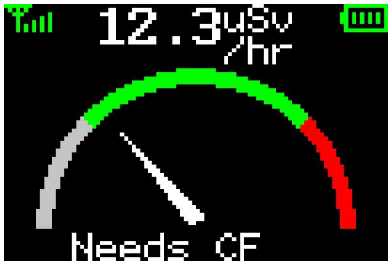

Figure 5 - POST Problem Message (in this case the unit needs factory re-calibration)

2 Charging, Connections & Memory

The PGT SAM-Lite has one watertight external connector for power, and DigiMesh wireless connectivity for communications.

The power connector is located on the rear side (TK) of the instrument facing away from screen, as shown below. Along the rear of the case there is a watertight connector for AC power (or car power/charger.) There is a flexible gray rubber port cover at the top (shown as partly transparent here.)

Figure 6 - Watertight connector for charging

2.1 Connecting AC Power or Car Adapter

A universal (110-240V, 50/60Hz) AC power supply is supplied with your SAM-Lite unit.

The car adapter plugs into a 12V accessory outlet or “cigarette lighter” outlet in your vehicle. It then connects to the same watertight connector on the SAM-Lite.

2.2 Battery Status and Charging

The built-in lithium-ion battery provides approximately 8 hours of operation with SAM-Lite in the default Search mode.

The battery meter in the upper right corner of the Dial Screen indicates the relative amount of charge remaining with a 4-segment bar graph, as shown below.

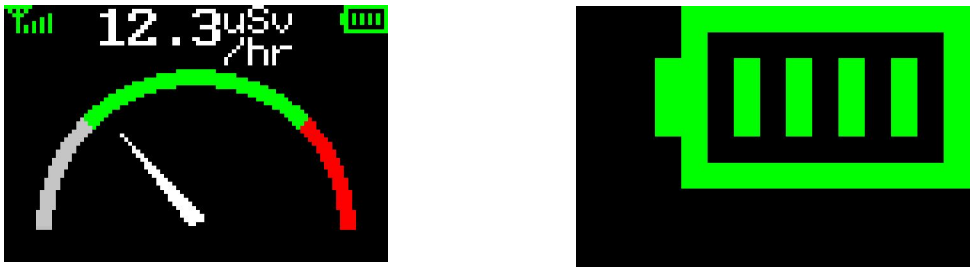

Figure 7 - Bar Graph Battery Indicator (in upper right corner)

2.2.1 Low Battery Warning

When the battery has just a few minutes of operation left, the color of the Battery Indicator changes. The battery icon is green when the batteries have at least ten minutes of useful life

remaining. It turns yellow when the batteries have between 5 and 10 minutes remaining, and then red when the batteries have less than 5 minutes left.

You should connect SAM-Lite to a battery charger immediately when this appears (AC adapter or car adapter).

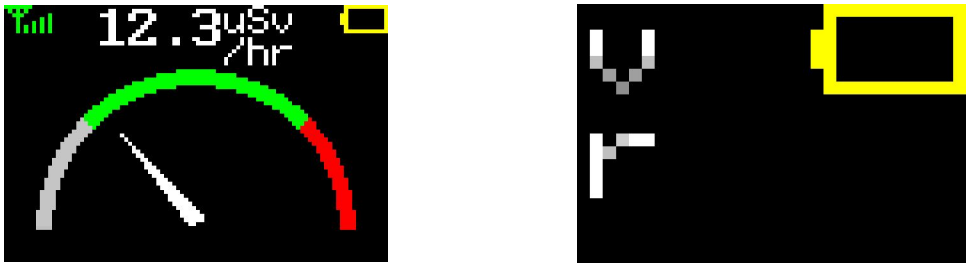

Figure 8 - Low Battery Indicator in upper right corner

2.2.2 Low Power Auto-Dim Mode

The SAM-Lite is designed so that it can be worn on a belt, and when the unit is in this belt-mounted vertical position it automatically enters a low power mode to reduce drain on the battery. The screen will dim. The unit continues to take measurements, to beep, and to automatically record measurements when increased radioactivity is detected while in low power mode. Holding the SAM-Lite in a horizontal position will return the display to full brightness.

2.2.3 Maximizing Battery Run Time

To get the most portable power between battery charges, use AC power when connecting to a PC or doing other stationary operations in the office. The unit will automatically run from AC power if it is available. (The battery charging function shuts off automatically when the battery is fully charged, so you can leave the AC or car adapter plugged in indefinitely.)

2.2.4 Servicing the Internal Battery

After fully charging the battery, SAM-Lite is designed to typically operate for 8 hours before needing to be charged again.

The battery is sealed within SAM-Lite and is not user serviceable. Over time, the amount of runtime the battery provides before needing a charge may gradually decrease. If you think the battery needs to be replaced, please contact your PGT dealer for more information on service and repair. *DO NOT ATTEMPT TO REPLACE THE INTERNAL BATTERY YOURSELF!*

2.3 Internal Memory

Your PGT SAM-Lite incorporates a secure internal memory module that saves data from each set of measurements that are taken. The memory is sealed within SAM-Lite and information from it can be copied using the wireless connection. Your PGT SAM-Lite memory does not require power to retain data. Even with the battery fully discharged for an extended length of time the data will be safely stored in memory.

2.3.1 Memory Capacity

The internal memory stores up to 32,000 spectra measurements. At the extraordinary rate of 1,000 measurements per day, this provides room for over a month's worth of data. At the more typical rate of 5 or 10 readings per day, many years' worth of readings can be stored.

2.3.2 Clearing Memory

The memory can be cleared using the SLReader software with the XStick wireless connection. You must be an Administrator to clear memory. See Appendix 5.1 for more information.

2.3.3 Note about Review Mode and Memory

The SAM-Lite Review Mode enables quick viewing of the last ten recorded measurements of elevated levels. For ease-of-use, only the ten most recent readings are available in Review Mode. However, the internal memory continues to store all readings, even after they are no longer viewable in Review Mode. You may use the wireless connection, described in the next section, to access readings after they are no longer visible in Review Mode.

2.4 Wireless Connection for Data Output

The wireless connection is easy to use, enables networking of multiple SAM-Lite units in the same vicinity, and helps keep SAM-Lite environmentally sealed (by eliminating the need for a mechanical connection). This connection employs the versatile DigiMesh networking protocol.

With this connection, you will be able to access data on the unit. The SLReader PC software application enables access to all readings of elevated levels. You can also analyze this data using optional Quantum™ software.

Connecting to most PCs will require the use of a USB-dongle style XStick wireless transceiver, available as an accessory along with the software that enables it. See Appendix for more information.

2.4.1 Wireless Signal Strength

The upper left corner of the display indicates the strength of the wireless signal.

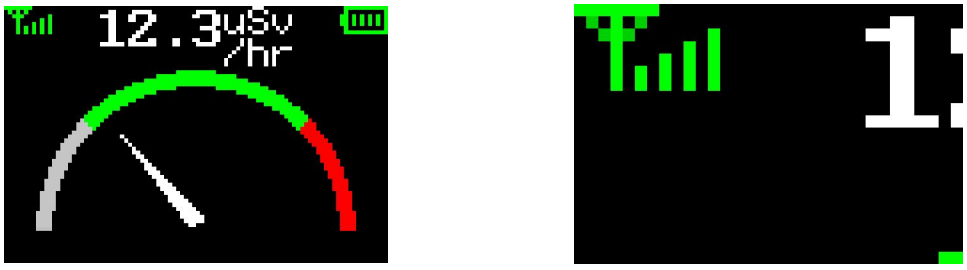

Figure 9 - Wireless Signal Strength Indicator in upper left corner

3 General Operation

The following sections describe the standard operating procedures for the SAM-Lite system including use of the different operating modes.

3.1 Turning the Power On and Off

3.1.1 Powering On

Turn on the PGT SAM-Lite by briefly pressing the center ENTER key. A logo screen appears for a few seconds while the unit initializes and conducts a self-test, and then the main Dial Screen appears.

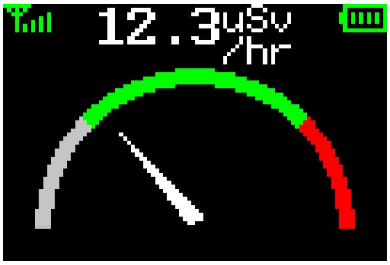

Figure 10 - PGT SAM-Lite Dial Screen

The instrument is ready for use when the Dial Screen appears. However, during the first few minutes of operation the unit continues to automatically calibrate itself.

To start taking readings, see Section 3.2, “Search Mode” below and Section 3.5, “Identifying Sources of Radioactive Radiation” on page 17.

3.1.2 Automatic Self-Calibration

During the first few minutes of operation SAM-Lite performs a series of automatic calibrations, intended to maximize accuracy as well as develop a profile of “normal” background levels for that area. A complete recalibration is usually complete within about three minutes. During this time, SAM-Lite may display an informational message at the bottom of the screen indicating that a calibration is needed (see figure TK). Although in an emergency data can still be collected while the unit is stabilizing, the built-in analytical software may not make correct identifications during this time. When the informational message at the bottom of the screen goes away, the system is ready to use.

Figure 11 - Dial Screen indicating calibration is needed (code letters may vary)

3.1.3 Screen Dimming

To save power and extend the available battery run time, the backlight on SAM-Lite's display is automatically dimmed when the unit is held vertically for a period of time, as would occur when worn on a belt. While dimmed the unit continues to take readings in Search mode, and beeping will continue.

3.1.4 Powering Off

Turn off the PGT SAM-Lite by pressing and holding down the center ENTER key for at least three seconds. A message/countdown will appear at the bottom of the screen indicating that Power Down will occur in 3, then 2, then 1 second. This feature is designed to help prevent accidentally turning the unit off: You can cancel the shutdown during these 3 seconds by briefly pressing the ENTER key again.

Figure 12 - Power Down countdown indicator

3.1.5 Battery for Internal Clock

The real-time clock has a separate internal lithium battery that keeps it running even when there is no other power source. (This battery is not user serviceable, please refer to your PGT dealer if it needs service.)

3.2 Search Mode

The Search mode (also called Auto-Collect) is the mode normally used to detect the presence of radioactivity and determine its location. It responds quickly and makes it easy to tell if something has changed, but provides less detailed analytical results. In this mode, the instrument continuously takes readings, searches for isotopes, and analyzes them for dose rate and other measurements.

Search mode is the default mode, it is the Dial Screen that you see after powering on SAM-Lite.

The main purpose of the Dial screen is to provide a quick visual indication, similar to that given by a handheld dose meter or Geiger counter, showing the amount of radioactivity being measured.

The Dial screen is divided into three main ranges, indicating relative degree of radioactive danger. There are:

- Gray Range - relatively low level, background
- Green Range - unusually high level
- Red Range - very dangerously high level

3.2.1 Gray Range

When the dial pointer is in the gray area, there is little radioactivity present – most of the counts are coming from either cosmic rays or naturally occurring sources (such as potassium-40). Beeps will typically be heard several times per hour.

3.2.2 Green Range

Once the pointer moves up into the green area there is an indication of some unusual activity. Beeping will increase to several times per minute, or more.

When the dial moves into the green area, SAM-Lite will automatically take measurements, the same readings it would take if you manually began a **Collect Data** operation (described in Section 3.5). A blue progress bar will appear at the bottom of the screen, indicating the progress of the collection, as shown below.

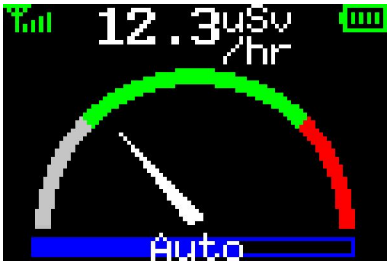

Figure 13 - Progress bar during automatic collection

3.2.3 Red Range

If the pointer moves into the red area, the activity is too high for a correct identification by SAM-Lite. It is *strongly advised* that you move back from the radioactive source, if at all possible, before attempting to identify it.

THE RED RANGE INDICATES A HIGH LEVEL OF DANGER!

3.2.4 Visual Alarm Warning

When a measurement exceeds pre-determined thresholds for safety within the green range, the reading will appear with a yellow background to warn you of dangerous radiation levels (see below). You should move away from the source quickly.

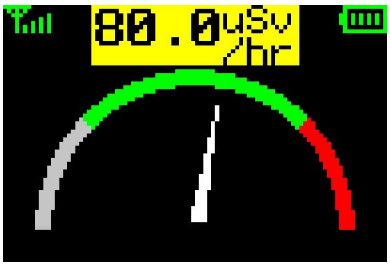

Figure 14 - Alarm indication

3.2.5 Critical Alarm Warning

When a measurement exceeds the threshold of the red range, the reading will appear with a red background to warn you of dangerous radiation levels (see below). *You should move back from the radioactive source immediately!*

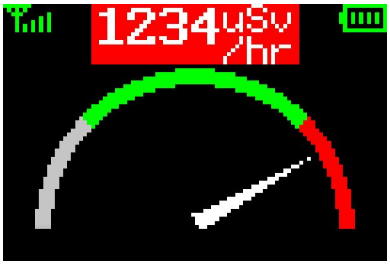

Figure 15 - Critical alarm indication

3.2.6 Internal Clock

SAM-Lite incorporates a highly accurate battery backed-up clock/calendar which is used to automatically time stamp all readings taken. This clock is pre-set at the factory and should not require any adjustment over the life of the unit. (If any problem with clock/calendar settings occurs, please contact your Administrator, or PGT authorized dealer for service.)

3.2.7 Sieverts/Hour Readings

SAM-Lite displays an overall radioactivity measurement at the top of the screen, in units called Sieverts/hour (Sv/hr).

Depending on detected levels, the range on SAM-Lite may automatically switch to display μSv/hour (millionths), or nSv/hour (billionths).

1 mSv/hr = 0.001 Sv/hr (one thousandth)

1 μSv/hr = 0.000001 Sv/hr (one millionth)

1 nSv/hr = 0.000000001 Sv/hr (one billionth)

See Appendix for more information about Sieverts, radioactive radiation measurements, and background levels.

3.2.8 Audible Beeping

There may be times when watching the display screen is inconvenient, either because you need both your hands free for other activities, or because you need a more inconspicuous way to monitor for radiation. In addition, the human ear is surprisingly sensitive to changes in rate, so you may find that you can better tell whether you are seeing abnormal radioactivity by listening to the audible beeping.

3.2.9 Automatic Background Readings

Background radioactivity levels vary widely from place to place. To ensure accurate results while providing a highly automated user experience, SAM-Lite employs a fully automated background level reading system. SAM-Lite dynamically self-adjusts for these changes in background level. The unit is intended to measure spot-localized radiation, and the confidence level displayed when increased radioactivity is detected represents the confidence level (in percentage) that there is a statistically significant increase over the current background level.

3.3 Collect Data Mode

With Collect Data you instruct the unit to take measurements immediately.

To activate Collect Data press the center ENTER button while in Search mode. A set of measurements (a spectra) will immediately begin. While the measurements are being taken, a progress bar appears along the bottom of the Dial Screen, as shown below:

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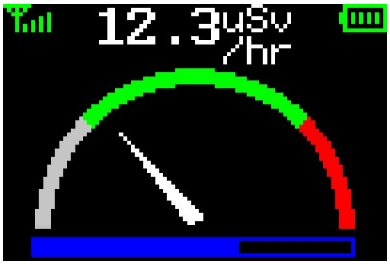

Figure 16 - Progress Bar During Collect Data

Recording Data

After the progress bar completes and data collection has concluded, a message will appear if the radioactivity measured exceeds predetermined threshold levels. The message asks if you want to record this data. Click Yes (➡ RIGHT button) to record the data, or No (⬅ LEFT button) to skip this step. (Warning: If you click No, you will have no record of this higher-than-normal measurement.)

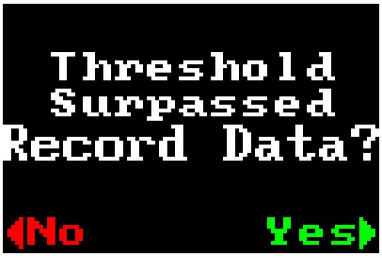

Figure 17 - Record Data After Collecting Data

3.4 Reviewing Spectra Data

SAM-Lite can store thousands of data collections in its internal memory. Each data collection set, also called a “spectra,” represents radioactivity detected at a particular moment in time. Each spectra is stamped with date and time information. Using a PC with the wireless connection to SAM-Lite, you can see all stored spectra information.

SAM-Lite can store approximately 30,000 spectra in internal memory. Spectra are automatically saved whenever a **Collect Data** process is completed. Spectra are also saved for each background taken and for certain other calibration operations. Each stored data set consists of a spectrum and all the information necessary to analyze it. They are stored in a standard format designed to comply with ANSI N42.42. You can review and (when desired) erase these spectra using a PC with the XStick wireless connection, described in detail in Appendix Section 5.1.

3.4.1 Review Mode

In Review mode all readings that exceed background levels, representing increased radioactivity, are displayed. Each set may contain from one to several specific radioactive substances that have been identified as elevated in radiation level.

SAM-Lite conveniently displays the 10 most recent sets of elevated readings in its Review mode. (You can view all stored spectra, not just the 10 most recent, by connecting to a PC with the wireless connection.)

To begin Review mode, press the ⬅ LEFT button. You will see the most recent stored reading.

Figure 18, for example (below), shows that we are looking at the first of 10 sets of data collections. The display shows that an increased level of Cs137 was detected as well as one more radioactive substance. Click the ENTER key briefly to see more detailed info about both the Cs137 and the “+1more” substance (see next section, Identifying Sources of Radioactive Radiation.)

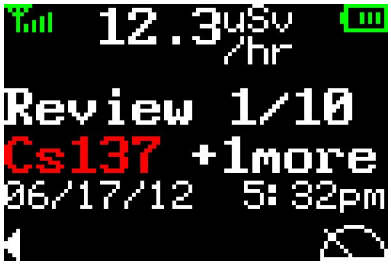

Figure 18 - Review screen showing the first of ten sets of measurements. In addition to CS137, one more radioactive substance has also been identified.

To see the next set of readings (the second of ten), press the the ⬅ LEFT button again. You can keep pressing the ⬅ LEFT button to move through the past 10 readings. After this, pressing the ⬅ LEFT button again will return the unit to Search mode.

In the example below (Figure 19), we are reviewing the tenth of ten data collection sets. The Dial icon in the lower left corner indicates that pressing the ⬅ LEFT button will end Review mode and return to Search mode.

Figure 19 - Review screen showing the tenth of ten sets of measurements. In addition Tc99m, four more radioactive substances have also been identified.

3.4.2 Current Radioactivity Level Display

Current Radioactivity Level Display

While in Review mode SAM-Lite continues to display the current radioactivity level at the top of the screen (In figure 19, for example, it is 200nSv/hr.)

3.4.3 "Normal" Radioactivity Levels

Normal readings will have significant variations based on location. Only with experience can the user determine what "normal" Sv/hr readings are.

The most likely causes for high background readings are:

- The presence of radioactive materials near the system in the form of samples or standards.
- High concentrations of natural radioactive material such as K40 in the building materials.

Less likely causes include:

- High radon levels.

See **Radioactivity Units & Background Radiation** in Appendix section 5.2 for more information.

3.5 Identifying Sources of Radioactive Radiation

SAM-Lite can help you determine the specific radioactive material(s) that is(are) present. The system has an internal library of many nuclides.

In Review mode, pressing the ENTER button brings up the identification screen(s) on the display.

Figure 20, below, shows an example of what the display would look like when 5 different radioactive substances are detected at elevated levels in the same reading. For each radioactive nuclide identified, the display shows:

- The substance (such as Uranium 235, or Cesium 137)
- The statistical confidence level that it has been properly identified (in percent)
- The amount of radioactivity measured in Sieverts per hour (Sv/hr), micro-Sieverts per hour (μSV/hr), or nano-Sieverts per hour (nSv/hr).

Figure 20 - Five different radioactive substances have been detected at elevated levels.

Pressing the ⬅ LEFT and ➡ RIGHT keys moves through these nuclide Identification screens. When the last screen is reached in either direction, the arrow icon will disappear from the lower left or right corner of the display.

3.5.1 Color Code Options

As you can see from the examples above, different types of radioactive substances may be identified by different colors on the display. The specific colors that appear on your SAM-Lite, and what they may represent, are a factory-customizable feature, as explained in more detail in Appendix 5.3.

4 Software Support

4.1 Software for first line responders

The SLReader software and companion XStick wireless communications system enable SAM-Lite users to quickly and easily view all detected isotopes stored in SAM-Lite's memory. See Appendix (next section) for more detailed information about installing and using this software.

4.2 Software for advanced users

The Quantum™ software is a useful tool for advanced users seeking additional analytical capabilities for their PGT SAM-Lite spectra. The Quantum software is supplied in two basic configurations, Quantum MCA and Quantum Gold.

Quantum MCA, a subset of Quantum Gold, is the "standard" software and provides qualitative, but not quantitative analysis. Qualitative analysis will allow analyzing for what isotopes are present, but not how much of each isotope is present. Certain features, such as background subtraction, are considered part of the quantitative analysis package and are not available in Quantum MCA. Quantum Gold supports both quantitative and qualitative analysis, and is the software the Quantum software manual is written for.

5 Appendix

5.1 The SLReader Wireless PC Connection

SAM-Lite Reader (SLReader) software makes it easy to review all detected isotopes in SAM-Lite's memory. SLReader communicates with your SAM-Lite unit using a wireless DigiMesh protocol. (DigiMesh is a proprietary peer-to-peer wireless networking topology. Its peer-to-peer architecture allows DigiMesh to be both easy to use and equipped with advanced networking features.)

DigiMesh wireless communications can be readily added to most PCs with a "Mesh XStick" USB dongle that plugs into an available USB port on your computer.

Three steps are required to get your wireless connection up and running:

1. Install the SLReader software
2. Install the XStick driver software
3. Plug the XStick into a USB port

These steps are described in more detail below.

5.1.1 SLReader Installation

Install the SLReader software and XStick driver before plugging the XStick into a USB port.

Depending on whether you're installing this software from a disc or from a download, the software installation may begin automatically, in which case you will see this screen (or something similar):

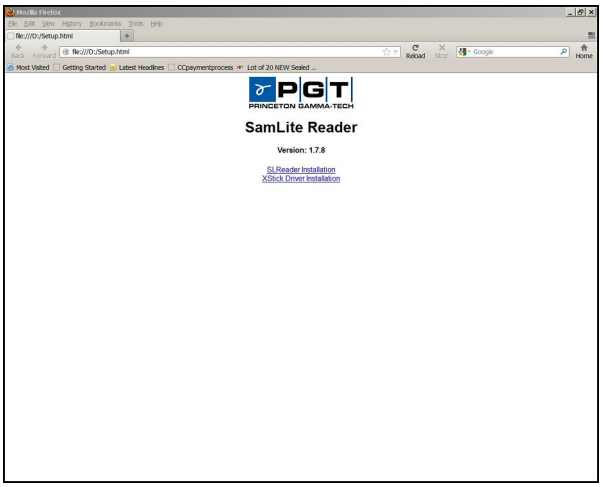

Figure 21 - SAM-Lite Software installation launch screen

If you don't see this screen, you'll need to navigate your way to the disc drive or directory where the installation software is located. For example if it's the E:\ drive, look for this file:

```
E:\autorun.exe
```

Double click on this file, and you should see the above screen.

Next, to install SLReader software, click on ”SLReader Installation.” You’ll see a screen that looks like this:

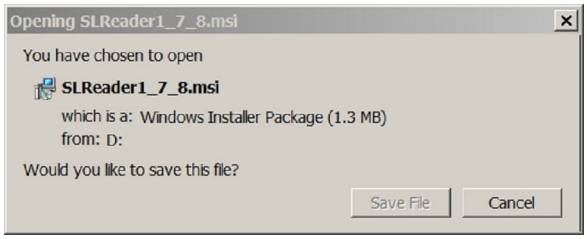

Figure 22 - SLReader installer

(Note: Click Yes or Allow to any Windows warning messages that may appear.)

After copying the installer program to your hard drive, the installer program should launch, and you’ll see this screen:

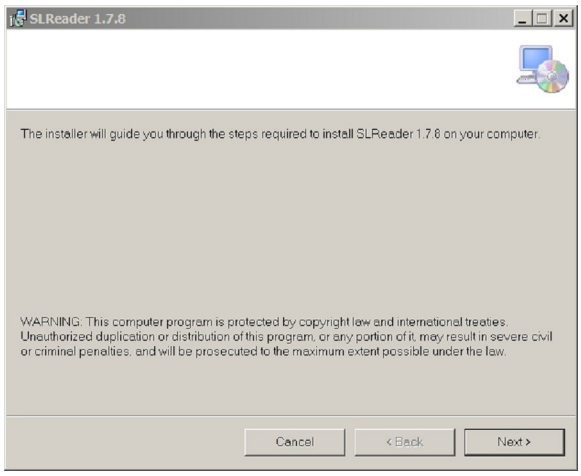

Figure 23 - SAM-Lite Software installation launch screen

Click Next, and you’ll see the option to change the location of the program file and access to the software.

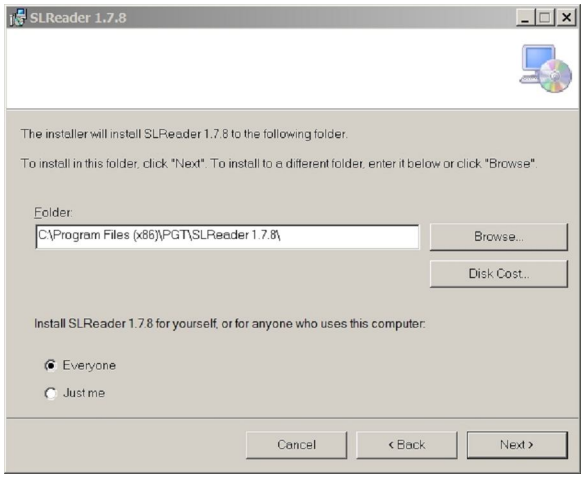

Figure 24 - SLReader installation options

For most installations, no changes will be needed here, just click Next, and installation should begin, as shown below:

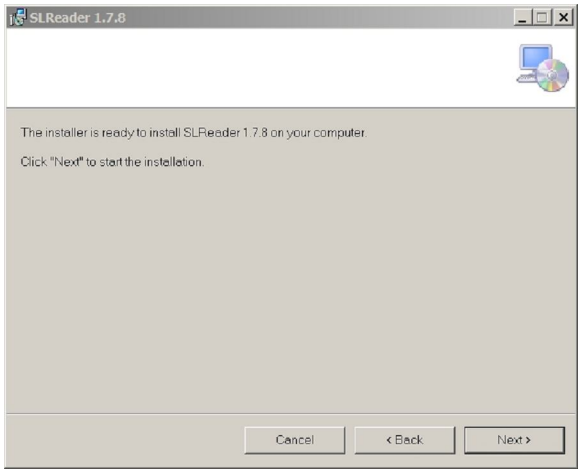

Figure 25 - SAM-Lite Software installation launch screen

Click Next, and when installation completes you'll see this screen:

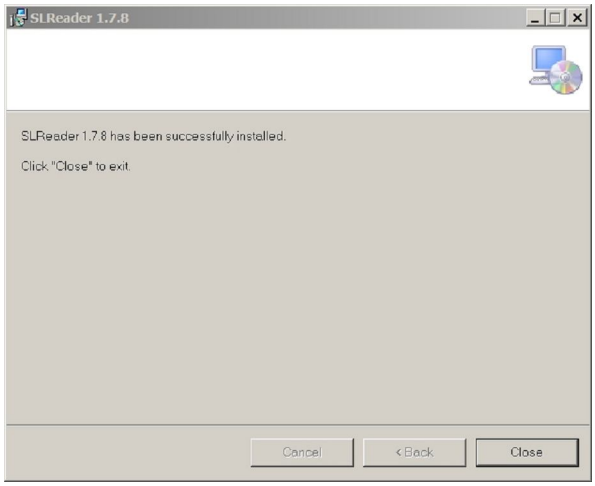

Figure 26 - SAM-Lite Software installation launch screen

Click on Close to exit the installation process.

After SLReader has finished installing an icon will appear on your computer's desktop. But before you launch this program, install the XStick Driver first.

5.1.2 XStick and Driver Installation

Do not insert the XStick into the computer until after you have installed the driver.

Go back to the SAM-Lite Software installation launch screen and click on **XStick Driver Installation** to begin. You will see a screen that looks like this:

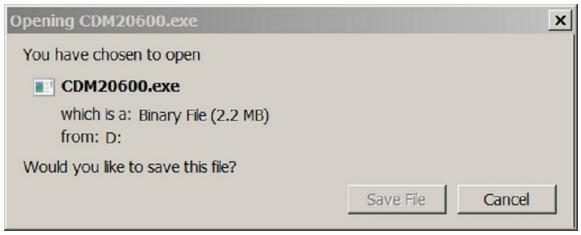

Figure 27 - SAM-Lite Software installation launch screen

Click Save File and installation should be completed quickly.

You are now ready to install the XStick into any available USB port on your computer. A Windows message will usually appear when you first plug it in, a few seconds later, indicating that the device is ready to use. You are now ready to launch the SLReader software, by double clicking on its desktop icon.

Note: SAM-Lite's power should be switched on when you launch SLReader.

5.1.3 Using SLReader

Double click the SLReader icon on your computer's desktop. It may look like this:

Figure 28 - SAM-Lite Software desktop icon (subject to chage)

When SLReader starts, the **Devices** tab will be selected and it will show all SAM-Lite devices within range of the wireless DigiMesh network.

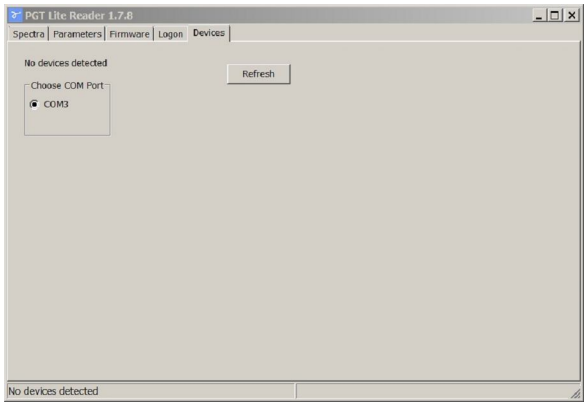

Figure 29 - SLReader Devices tab (showing none found here)

If it does not display the SAM-Lite unit you are trying to communicate with, click the Refresh button to initiate a scan for devices within range. You will see a screen that looks like this:

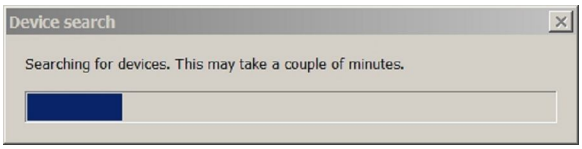

Figure 30 - Searching for nearby SAM-LIte units

The **Spectra** tab displays a list of detected isotopes. This is the main area that shows all SAM-Lite readings.

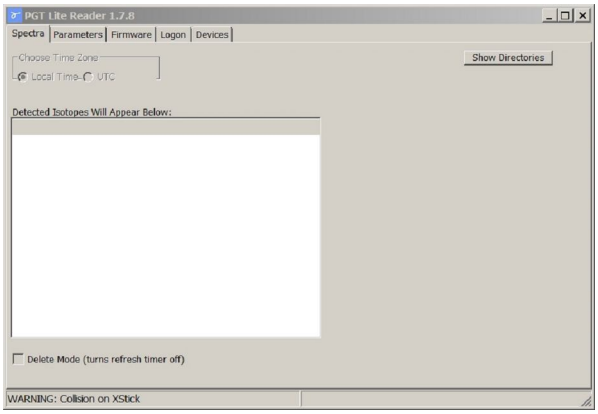

Figure 31 - SLReader Spectra tab

The Spectra section of SLReader software is intended as a basic way to view stored detected isotopes. For more advanced analytic tools, the optional Quantum MCA or Quantum Gold software products are recommended.

Note: SAM-Lite's power should be switched on when you launch SLReader.

5.1.4 Administrator Operations

The remaining tabs in the SLReader software are for use by Administrators only.

The **Logon** tab requires entering a password for full Administrator privileges, including firmware updates.

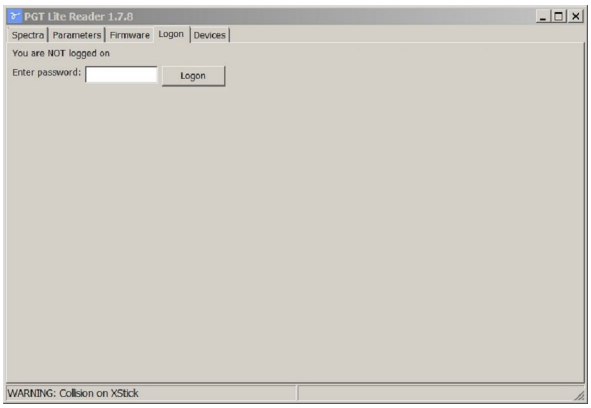

Figure 32 - SLReader Logon tab

The **Firmware** tab enables updating SAM-Lite's firmware. This is for Administrator use only.

The **Parameters** tab, for Administrator use only, enables customizing of SAM-Lite.

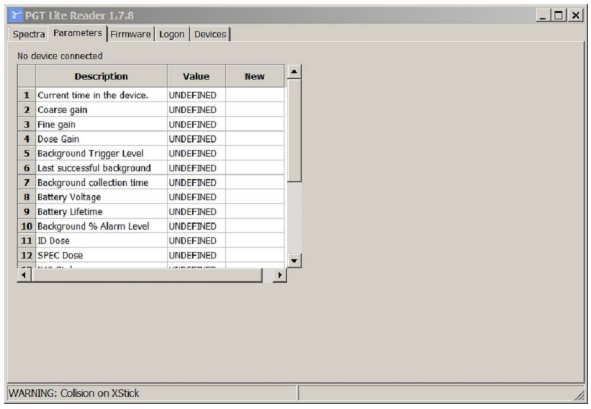

Figure 33 - SLReader Parameter tab

The SLReader software is intended as a basic way to view stored detected isotopes. For more advanced analytic tools, the optional Quantum MCA or Quantum Gold software products are recommended.

5.2 Radioactivity Units & Background Radiation

5.2.1 Understanding Radioactivity Radiation Units

PGT SAM-Lite displays measurements of radioactivity in units called Sieverts per hour (Sv/hr), or millionths of a Sievert per hour (μSv/hr) or billionths of a Sievert per hour (nSv/hr.).

At the heart of radioactive radiation is the disintegration of a subatomic particle, and the earliest measurements of radioactivity measured this disintegration activity. The **Becquerel** (Bq) is equal to one disintegration per second. The **Curie** (Ci) is equal to 3.7×10^{10} disintegrations per second.

However, with concerns of risk to human health in mind, a more useful measure of radioactive radiation is based on the absorbed dose. In this system, one **Gray** (Gy) is equal to one joule per kilogram of tissue. The more commonly known unit called the **Rad** is equal to one hundredth of a Gray.

The **Sievert** (Sv) is based on the Gray unit of absorbed radiation, and adds the idea of equivalent dose in X-ray radiation. One Seivert is equal to one Gray of X-ray radiation, or the equivalent dose of alpha or beta particles in their effect on human tissue. This is the most relevant measure of the danger that radioactive radiation presents. The Sievert (and the Rem) are direct indications of danger to human life.

The **Rem** is one hundredth of a Sievert:

1 Rem = 0.01 Sievert = 10,000 μSv

As radioactivity, such as the radiation from a radioactive substance is emitted as a steady stream, radioactivity is most commonly measured over time, such as Sieverts per hour (Sv/hr).

It is the total accumulated exposure, however, more than the rate per hour, that should be considered when evaluating threats to human health. For example, in the U.S. the NRC limit for nuclear power plant workers is 5,000 millirems per year, or 5 rems per year, which is .05 Sieverts per year or 50,000 μSv per year. Workers in nuclear power plants wear badges that measure the accumulated radiation total.

5.2.2 Background Radioactive Radiation

In most parts of the world, typical background radiation levels are about 200-400 millirems per year, or .002-.004 Sv or 2,000-4,000 μSv. On an hourly basis, that works out to about 0.23 to 0.46 μSv/hr (or 230 to 460 nSv/hr).

However, background radiation can vary significantly from one specific place to another. Because of this variation, PGT SAM-Lite continuously and automatically re-adjusts its sensitivity to compensate for local background radiation levels.

5.2.3 Sources of Background and Household Radioactive Radiation

There is always background radioactivity present. Radioactivity is a naturally occurring phenomenon. Here are some common sources of radioactivity, both natural and manmade:

Radon is a significant source of background radiation, depending on geography. Radon comes up from the ground.

Bananas are also slightly radioactive. Granite countertops and building features, such as steps, can be slightly radioactive. Household smoke detectors contain a small amount of a radioactive substance. Glow-in-the-dark wristwatch and clock markings can be radioactive. Some

“Fiestaware” plates and bowls made in the 1950s are slightly radioactive. Above-ground tests of nuclear weapons in the 1950s have slightly elevated the background radiation in the atmosphere, as have some releases of radioactive radiation from nuclear power plants, especially when major accidents have occurred.

5.3 Color Codes

PGT SAM-Lite includes the ability to tag identified nuclides with a color code, to help the operator more quickly identify problems. This feature is customizable at the factory and by administrators, so the specific scheme used in your SAM-Lite may vary from the example shown below.

In a typical color code setup, four different nuclide “classes” are defined by their colors, which appear as the text color of the identified nuclide. These are:

Figure 34 - Typical color code setup

Magenta for special nuclear materials (SNM)

Cyan for medical (MED)

Green for naturally occurring radioactive materials (NORM or NRM).

Yellow, for uncertain (UNC) when there is insufficient data to be sure something is present

or

Red, for unknown (UNK) when there is something definitely present but not matched to any currently identifiable nuclide.

In the example below, Uranium-235, shown in Magenta, is identified as special nuclear materials.

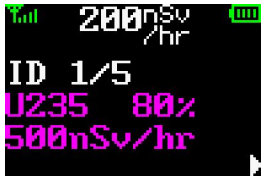

Figure 35 - Uranium-235 is shown in magenta.

6 Specifications

Preamplifier

Type:	Charge Sensitive
Input:	Negative Current (anode)

ADC

Type:	14-bit pipelined
Speed:	20 MHz

Pulse Processing

Type:	Analog, Bipolar Gaussian
Shaping time:	(TBD - Rob, can you investigate?) TK
Gain:	Analog 1x to 16x; Digital 0.75x to 2.0x
LLD:	0 to 100% of full scale digitally adjustable in .0015% intervals
ULD:	0 to 100% of full scale digitally adjustable in .0015% intervals
Zero:	Corrected by energy calibration

Spectrum Conversion

Collection Mode:	Linear – 65,536 Channels
Conversion Modes:	QCC - 256 Channels (U.S. Patent 5,608,222)

Spectrum Storage

Memory:	Internal 1GB flash, up to 30,000 spectra

System Controller

Processor:	ARM9 CPU at 40 Mhz
Display:	96x64 high contrast 64000 color OLED
Controls:	3-key custom keypad
I/O:	802.15.4 wireless mesh (DigiMesh)
Clock:	Battery-backed-up clock/calendar

Power

Batteries:	Internal, 2.4Ah LiIon battery
AC:	35W 12V universal AC adapter
Auto:	12V fused accessory adapter
Connector:	Watertight connector for charging

Gamma Detector

Crystal:	1" x 1" NaI
Bias:	Integral HV supply factory set for detector