BERKELEY NUCLEONICS

USER MANUAL

Model SAM 950

USER MANUAL
™ SAM 950

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CHAPTER 1. INTRODUCTION

The SAM 950 is designed to meet the requirements of ANSI 42.34 criteria for hand-held instruments for the detection and identification of radionuclides.

This instrument provides a superb solution for the demanding requirements of emergency responder and Homeland Security in the USA and other countries. Our solution replaces traditional designs with a unique solution that seamlessly integrates a powerful PDA or Smartphone with the Nuclear Radiation measuring detectors.

The SAM 950 unit is designed to accommodate various type and size of radiation detectors, available detectors are: 2x2 or 3x3 inch NaI(Tl), 1.5x1.5 or 2x2 inch high resolution detectors such as LaBr3 or CeBr3. The unit also equips a supplementary GM tube which takes over measurement of high dose radiation when it exceeds 10 mR/h. A solid state neutron detector, 'Domino', which has small form factor with superior gamma rejection than He-3 detector can be added optionally.

One of the most distinctive features compared to the conventional hand-held RIIDs are attaching photo, video and/or voice/text comments to the event file. In addition, measured events can be sent via WiFi network to a reach-back center and/or RadResponder site in real time. These feature are enabled by the powerful smartphone application SW, PeakAbout II.

Data acquisition is securely conducted via wired connection to the Personal Digital Assistant (PDA) unit. The standard PDA unit is the Samsung J5 or equivalent. The PDA display provides the user with easy to read information providing assessment of current radiological levels including personal safety and radionuclide identification. Upon completion of a survey the data may be downloaded from the PDA unit to the PC. The optional GPS unit provides the data necessary for mapping of the radiation levels.

Figure 1.1 SAM 950

Emergency Responder   Homeland Security

Figure 1.2 Application examples

IMPORTANT SAFETY INFORMATION

The SAM 950 has been meticulously engineered to provide safe, dependable, high performance to it's user for years to come. But, as with any kind of electrical equipment, following instructions and taking basic precautions will prevent injury to yourself or to the equipment. Therefore, prior to using this equipment you should:

- ✓ Read and understand this manual thoroughly.

- ✓ Store all provided documents in a safe place for future reference.

- ✓ Especially be sure to read the "SAFETY" chapter of this manual and thoroughly understand all warning and caution labels.

PRODUCT WARRANTY

Description of the BNC warranty for the SAM 950 handheld RIID systems:

- ✓ The unit is warranted to be free of defects in material and workmanship, including: parts, labor and all unit elements.

- ✓ Unless otherwise indicated, the warranty is good for 12 months after delivery to the original buyer only.

CHAPTER 2. SAFETY

CAUTIONS AND NOTES

The following warnings and instructions are vital to the optimal operation of the   SAM 950 unit and should be made readily accessible for reference. Follow these warnings and instructions thoroughly to use the unit correctly and to protect the safety of the users.

⚠ Handling Instructions:

✓ The maintenance service of the unit should only be handled by qualified/trained personnel
✓ Cleaning the Camera and Flash lamp Windows: clean the windows with a soft, moist cloth to keep them clean and clear. Turn off the power before cleaning.

⚠ Safety Hazard Warnings:

✓ It can be very hazardous to open the unit on account of high voltage inside the unit (high voltage in the detector is up to 1000 Volts). Be sure to refer all servicing to qualified/trained personnel.

⚠ Disposal Instructions:

✓ If/when disposing the unit: observe local and national regulations for the disposal of units containing a lithium battery.
✓ Do not use household of municipal waste collection services for disposal of electrical and electronic equipment. EU countries require the use of separate recycling collection services.

⚠ WARNING:

✓ External equipment intended for connection to signal input, signal output or other connectors, shall comply with relevant EN Standard (e.g., EN 61326-1:2013, EN 301 489-1 V1.9.2 and EN 301 489-17 V2.2.1).

✓ If, in doubt, contact qualified technician or your local representative.

SAM 950 CONTAINS FCC ID : U8D-FB155BC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operations.

CALSSIFICATION

✓ EMC: Comply with EN 61326-1: 2013, EN 301 489-1 V1.9.2 and EN 301 489-17 V2.2.1)

✓ FCC Class**:** Class B Equipment (FCC CFR 47 part 15 subpart B, Section 15.101)

✓ Laser: Class II Equipment (Max. output: < 1mW, Wavelength: 650 – 660 nm)

✓ Degree of protection against electric shock: Type BF Applied Part

✓ Degree of protection against the ingress of water: IP65

✓ Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

LABELS

The label providing the system power requirements and serial number of the system is located at the back-side of the unit.
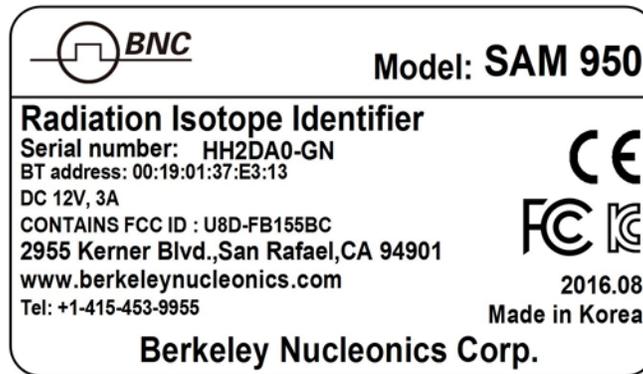

Figure 2-1. Label

CHAPTER 3. SYSTEM DESCRIPTION

SYSTEM COMPONENTS

SAM 950 components, its accessories and carrying case are shown in figure 3.1.

Figure 3.1. SAM 950 Components, its accessories and carrying case

① SAM 950 detector unit

② DC power adaptor for SAM 950 (DC 12V)

③ Vehicle charging adaptor

④ Shoulder strap

⑤ Water and shock proof carrying case

SPECIFICATIONS

✓ **Specifications**

INPUT / OUTPUT			
USB	Micro USB 2.0, IP65	AC Adapter	12v, 3A
Camera	CMOS 13.0 MP	Speaker	84dB(1W/0.5m), Water Proof
GPS	Built-in GPS in Smartphone	Display	5 inch touch screen

PHYSICAL	
Dimensions (W x D x H)	192 x 356 x 214 (mm)
Weight	4.3kg (9.5lb) w/ 3x3 inch NaI(Tl), 3.2kg (7 lb) w/ 2x2 inch NaI(Tl), 3kg (6.6lb) w/1.5x1.5 inch LaBr$_3$. CeBr$_3$

ENVIRONMENTAL	
Operating Temperature	-20℃(-4℉) ~ 50℃(122℉)
Relative Humidity	10 to 80%, non condensing

PERFORMANCE	
Energy Resolution (Gamma)	NaI(Tl) 2x2, 3x3 inch :< 8%@662Kev, LaBr$_3$ 2x2 inch :< 3.5%@662Kev, CeBr$_3$ 2x2 inch :< 5%@662Kev
Energy Range (Gamma)	20 Kev – 3 Mev
MCA channel	10bit, 1024 channel
Dose rate range	0 – 10 mR/h (NaI), 10 mR/h – 10 R/h (GM)
Stabilization	Automatic real-time stabilization using K-40
Nuclide Identification	According to ANSI N42.34, isotope/category/confidence report
Battery	>8hours, Lithium Ion

DETECTORS	
Gamma Detector	NaI(Tl) – 2x2, 3x3 inch, CeBr3 – 1.5x1.5, 2x2 inch, LaBr3 – 1.5x1.5, 2x2 inch
Gamma (High Dose Rate)	Gain Compensation Geiger-Muller detector

Neutron (Optional)	Solid-state Neutron detector : 4cm² active area, 20% thermal neutron eff. Gamma rejection: 1: 107
SOFTWARE	
Reach-back Feature	ANSI N42.42 or CSV event data via a Smartphone (Wi-Fi)
Application SW	Android based application SW for Smartphone, Windows based application SW for Command Center

Detectable Idotope List

NORM	K^{40}, Ra^{226} and daughters, Th^{232} and daughters
Medical	F^{18}, Cr^{51}, Ga^{67}, Mo^{99}, Tc^{99m}, Pd^{103}, In^{111}, I^{123}, I^{125}, I^{131}, Xe^{133}, Sm^{153}, Tl^{201}
Industrial	Na^{22}, Co^{57}, Co^{60}, Se^{75}, Rh^{106}, I^{132}, I^{133}, Ba^{133}, Cs^{134}, Cs^{137}, Eu^{152}, Ir^{192}, Am^{241}
SNM	U^{233}, U^{235}, U^{238}, Pu^{239}, Pu^{241}, Np^{237}

POWER AND BATTERY CHARGE GUIDE

Figure 1.4 shows the location of the power switch and the DC connector for charging the internal battery. The LED turns red when the power is ON.

The battery charger (figure 3.2 below) has a built-in overcharging protection circuit. Once the battery is fully charged the LED turns green and auto charging is terminated.

The power system of PDA is directly connected and controlled by the SAM 950's internal battery. Therefore, PDA's operation time is same as the SAM 950 unit and it's On/Off is synchronized with the SAM 950 unit.

Figure 3.2. Power switch and battery charger

SAM 950 also can be charged by vehicle electric system with standard 12 V DC. Figure 3.3. shows a vehicle charging unit.

Figure 3.3. Vehicle charger

The SAM 950 is equipped with a Lithium Ion battery. The battery has a built-in power protection circuit (PCM) which prevents the battery from both overcharging and over-discharging.

⚠ Hazard: Internal high voltage (up to 1,000 volts)! Do not disassemble the unit.

⚠ Servicing of the unit should be performed by BNC qualified personnel.

CAMERA AND FLASH LIGHT

SAM 950 is equipped with built-in camera and a LED flash light for recording media information and operation in dark environment.

✓ Push and hold (2 seconds) the 'up-arrow' button with a lamp icon (refer to the figure 3.4), the LED flash light is turned ON. With same manner, the flash light is turned OFF.

Figure 3.4. Camera and flash light

TRIPOD ASSEMBLE GUIDE

SAM 950 can be mounted on a tripod. A tripod adaptor hole is located on the bottom of SAM 950 as shown in figure 3.5.

Standard tripod screw shoe size is 3/8-16. Front and back hole are designed for 3x3 inch and 2x2 inch (1.5x1.5 inch) detectors, respectively by considering weight balance.

Figure 3.5. Tripod adaptor holes and SAM 950 mounted on a tripod.

SHOULDER STRAP ASSEMBLE GUIDE

To minimize fatigue of an operator, SAM 950 can be wearing on shoulder using a shoulder strap.

✓ There are two strap hocks at front and back of the SAM 950 body. Assemble example is shown in figure 3.6.

Figure 3.6. Shoulder strap assemble examples

SAM 950 SOFTWARE

SAM 950 software consists of two programs.

1. "SAM III PeakAbount II": application software for the PDA
2. "SAM III PeakID": command center software for a PC running the Windows Operating system.

The PDA application software is preinstalled in the imbedded PDA.

The PDA application SW is used in the configuration and calibration procedures as well as for the real-time measurement and analysis of spectral data acquired by the SAM 950.

The command center software supports event-log file management, integration of data from multiple units, and data backup.

For detailed installation instructions please refer to the appropriate sections in this manual.

Command center software is compatible with Windows based PCs. The OS must be Windows 7 or higher.

PREREQUISITES FOR THE OPERATION OF THE SAM 950

✓ **Charge the SAM 950 battery**

1. Turn off the system (recommended for fastest time to full charge)

2. Plug-in the DC adaptor to the DC connector

3. The LED on the DC power adaptor changes to green when the unit is charging.

4. Full charge may take up to 6 hours.

5. The LED on the DC power adaptor OFF when the unit is fully charged.

6. The charging cable is securely locked to the female connector on the unit. Disengage the spring loaded connector by firmly holding the male connector and gently twisting ¼ turn, then pulling straight back on the connector.

For detailed setup, configuration, background measurement and calibration procedures please refer to the appropriate sections in this manual.

CHAPTER 4. PDA APPLICATION SOFTWARE

INTRODUCTION

The built-in PDA communicates with the SAM 950 unit through wired USB network protocol. Its main function is to provide dose (and count) rate data for the gamma-ray. In addition it provides the operator with a convenient graphic status display and access to the analytical tools. It also manages the configuration and calibration of the paired SAM 950 unit.

The SW is Android (Google) OS based and compatible with any Android based PDA or Smart Phone. The standard unit imbedded with the SAM 950 is the Samsung Galaxy J5 or equivalent. In addition to touch screen in handling the imbedded smartphone, it can be also controlled by hardware button keys on the handle of the SAM 950 unit.

Figure 4.1. Main screen

FUNCTION BUTTONS

The function buttons of SAM 950 on its handle provides convenient control and operation of the unit in addition to the touch screen capability. A user can operate the buttons with wearing a glove. The basic function of each button is summarized in table 4.1.

The button key provide different functions based on menu hierarchy status. Details are described in each operation mode sessions.

Figure 4.1. Function buttons on the handle.

Table 4.1. Basic function of function key buttons

◀ ▶	Left / Right Move	
▲ ▼	Up / Down Move	
ENTER	Click	Selection/execute
	Click & Hold (2 sec)	Manual Source ID Start
MENU / ⮌	Click	Back to previous menu
	Click & hold (2 sec.)	Return to main Menu
▲	Click & hold (2 sec.)	Light on / off

SOFTWARE UPGRADE GUIDE

SW update notification message is automatically sent and displayed when the latest SW version is available and the currently installed version is lower than the latest one.

The SAM 950 unit has to be connected WiFi network to download/upgrade to the latest SW.

✓ Following is software upgrade procedure. Refer to the figure 4.2 below.

1. SW upgrade notification message is appeared on the low bottom of the main screen as shown in figure 4.1. only if the currently installed version is lower than the latest one.

2. To upgrade, go to the Device Information by following path: Pop up menu (by press and hold MENU/⤺) → Setup → Device Information

3. Touch and select 'Download latest SAM III SW'.

4. Type in 'BSN" number and select 'PeakAbout II' PDA application SW.
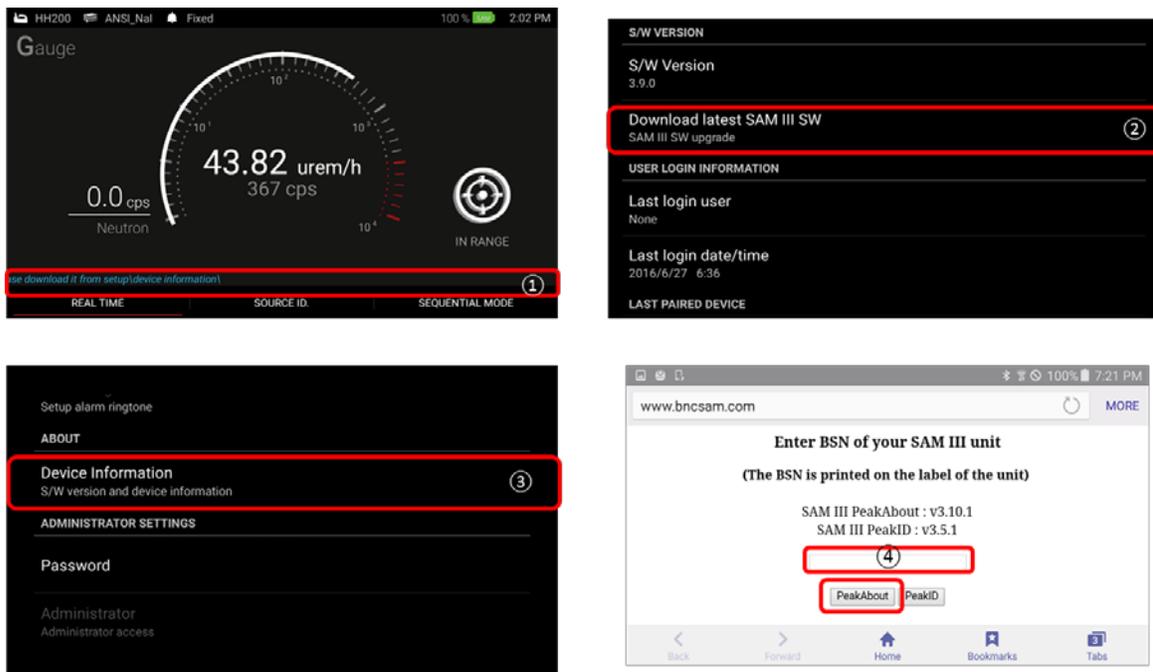
BSN (BNC Serial Number) is located on the label.

Figure 4.2. SAM III SW upgrade procedure

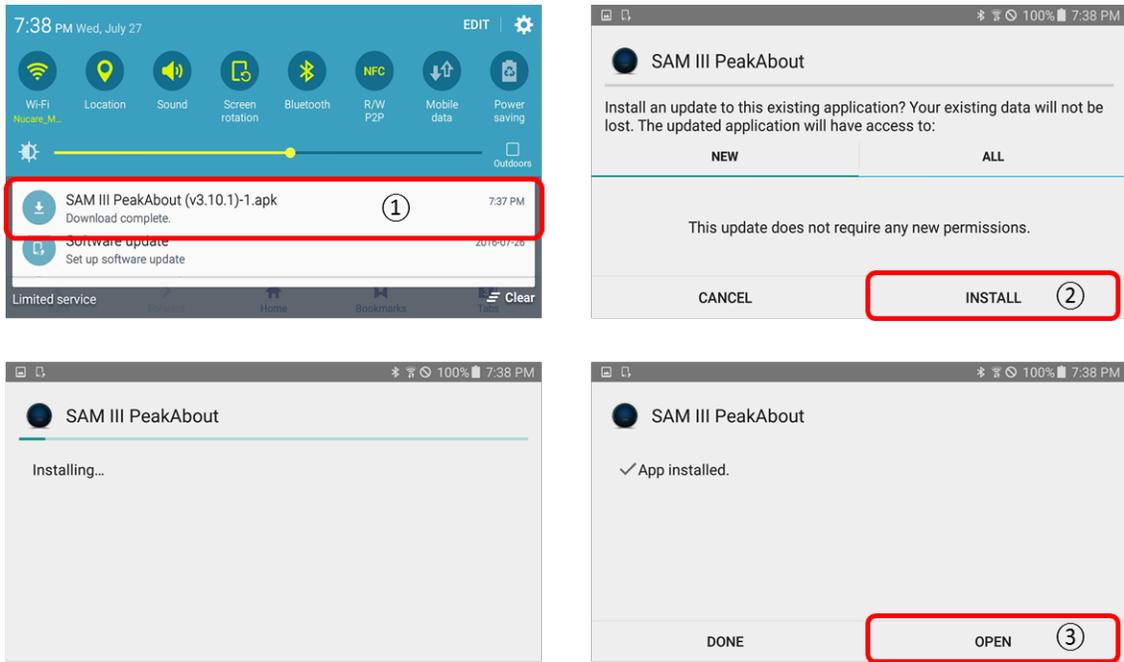5. Installation screen is opened as shown in figure 4.3. Follow 4 steps below.

Figure 4.3. SAM III SW upgrade procedure

MAIN AND SUB-MENU STRUCTURE

Measurement status display, configuration, event log management, reach-back service, media file generation, spectrum analysis, background measurement and calibration are all managed by the PDA and its application software.

Intuitive, simple and hierarchical structure design of the new PeakAbout II software make the operation of SAM 950 easy and flawless. In addition, function buttons on handle provides extra convenience in handling the unit with wearing gloves.

Figure 4.4. and 4.5. graphically summarizes hierarchical structure of menus and describes how to use touch screen or function buttons in order to surf between menus.

Figure 4.4. shows menu structure for event generation, manual ID and media file attachment procedure. And Figure 4.5. covers structure for setup and event log management related tasks.

✓ **Menu structure of manual ID and media file attachment**

- The main 'Gauge' ① and 'Finder' ② screen can be toggled by pressing up/down [A▼] function button or swiping up/down with a finger on the touch screen.

- 'Manual ID' screen ③ is access by press and hold [ENTER] key or touch 'Manual ID' menu on the screen from the 'Gage' menu any time.

- The 'Spectrum' ③ and 'Classification' ④ screen can be toggled by pressing left/right [◄ ►] function button or swiping left/right with a finger on the touch screen.

- 📌 Stop ID and return to main screen by press [MENU/↩] button from either 'Spectrum' ③ or 'Classification' ④ screen. In this case, the event is deleted.

- When manual ID is completed, 'Event summary' ⑤ screen is automatically popped-up. In this screen, user can send the event to Reach-back ⑥ and/or RadResponder server ⑦ or attach media files such as text/audio comment ⑨, photo(s) and video(s) ⑧.

- Pressing [MENU/↩] button from the 'Event summary' ⑤ screen saves event data and returns to main 'Gauge screen ①.
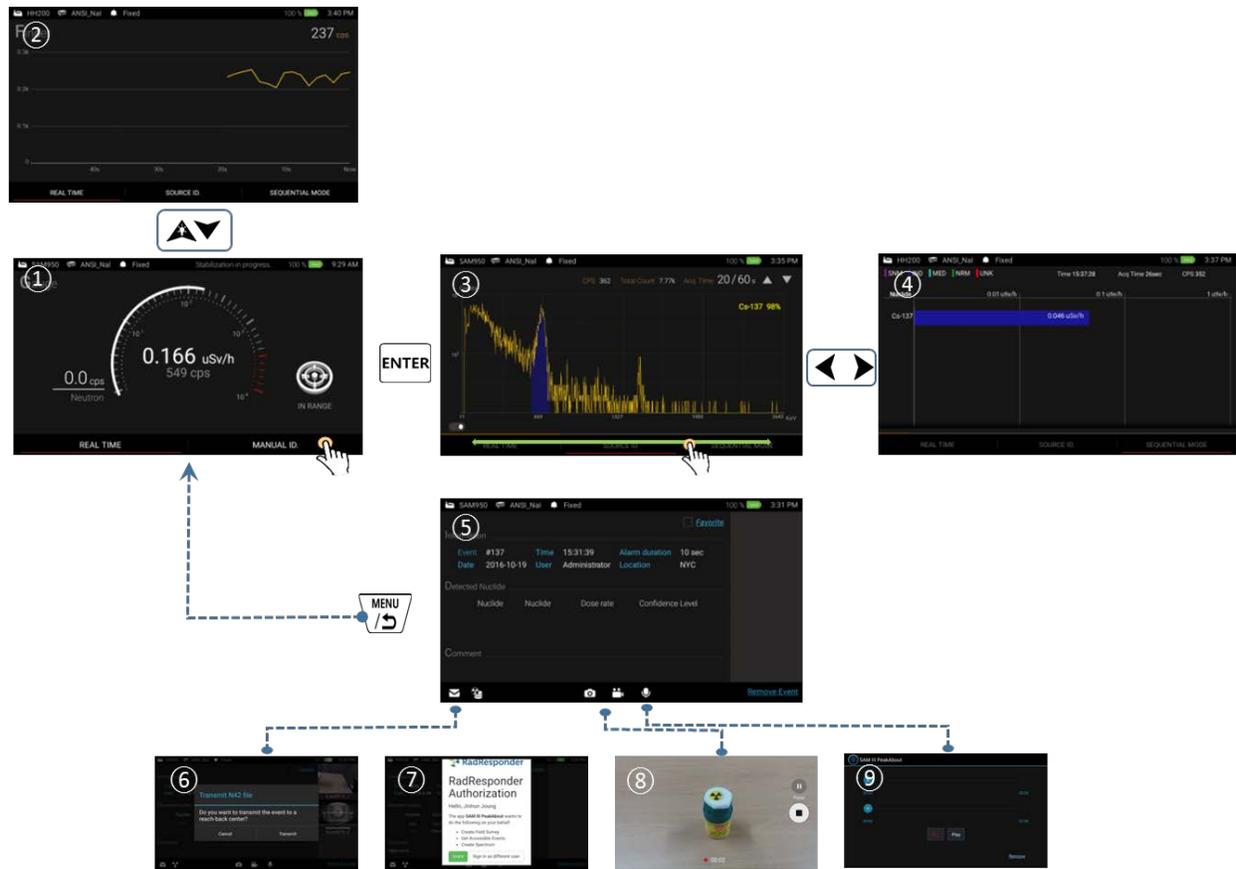
Figure 4.4. Menu structure of manual ID and media file generation.

1	Main GUI screen	Dose rate, Count rate, System status, menu and battery indicator
2	Finder screen	Display real-time radiation activity by time
3	Manual ID screen	Manual ID screen with spectrum, ID result display.
4	ID classification screen	ID analysis and classification, dose rate information
5	ID summary screen	Manual ID condition, ID summary, media management
6	Reach-back screen	Reach back service screen
7	RadResponder screen	RadResponder service screen
8	Photo/video	Attach photo(s) and video(s) to the event
9	Voice msg.	Record voice comment to the event

✓ **Menu structure of setup and event log management**

The setup and event log management features are intentionally hide from the main tasks such as 'Manual ID' and 'Media file generation' explained above in order to avoid busy traffic and complications in operation. The setup and event log management can be accessed by press ⟍MENU/⤺⟋ button from the main screen. The pop-up menu is appeared and allows user to jump to the setup and event log screen.

- 'Setup' ④ and 'Event log' ③ screen is accessible by selecting appropriate menu from the pop-up menu on the main screen.

- 'Event log' screen ③ allows several tasks such as event analysis, Reach back service, RadResponder ⑤ service, and etc.

- 'Setup' ④ allows user to configure various parameters such as calibration ⑥, sequential mode programming, alarm threshold ⑦, ringtone selection ⑧, account setup and more.
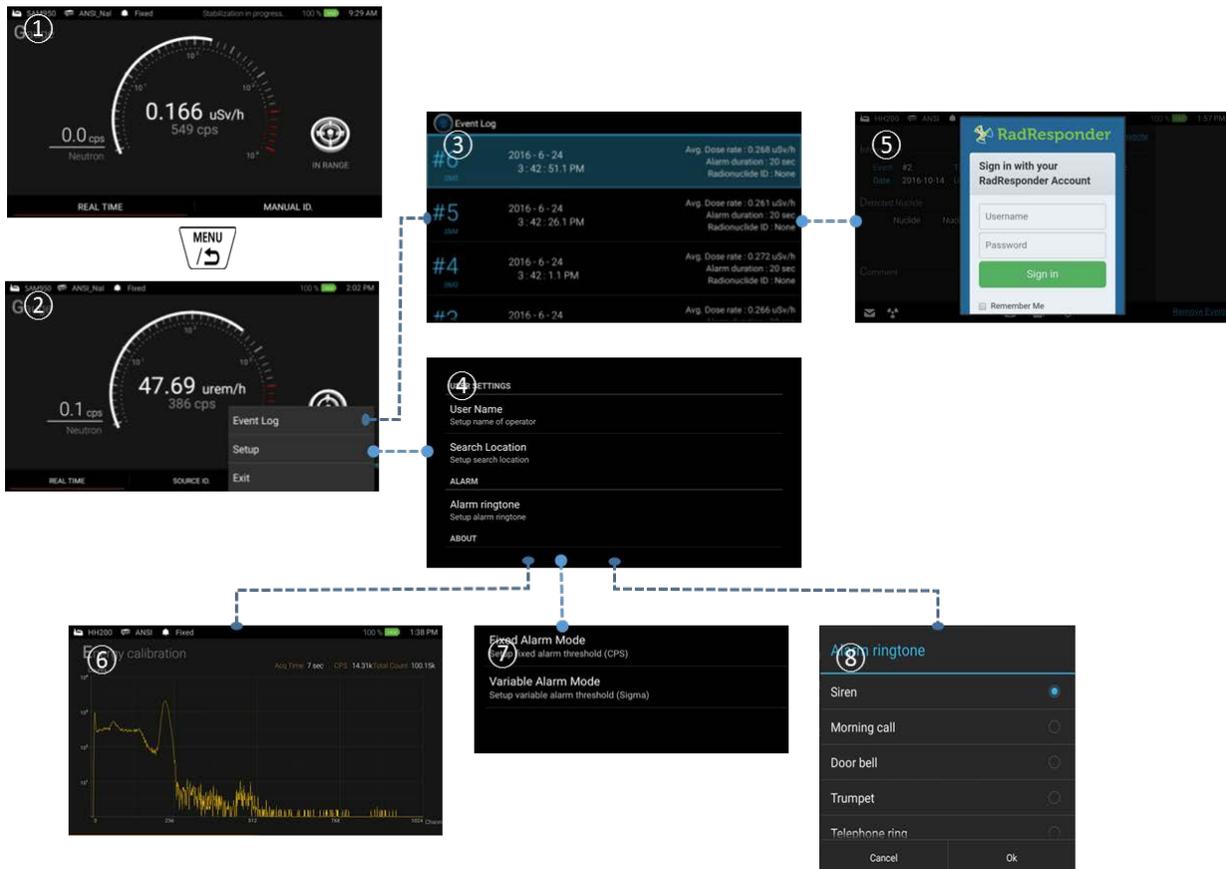

Figure 4.5. Menu structure of setup and event log management.

PRIMARY GUI

Primary GUI is the main home screen that primarily contains Gamma and Neutron activity information. In addition, library, alarm status, and battery indicator information are also displayed. The primary GUI is the gate way to major takes such as 'Real Time' activity analysis, 'Source ID', and optional 'Sequential mode' access. Those menus can be accessed by touching corresponding menu tab located on the bottom of the primary GUI as shown in figure 4.6. or pressing function buttons on the handle.

The primary GUI and its components are shown in figure 4.6. Details are provided in the following sections.
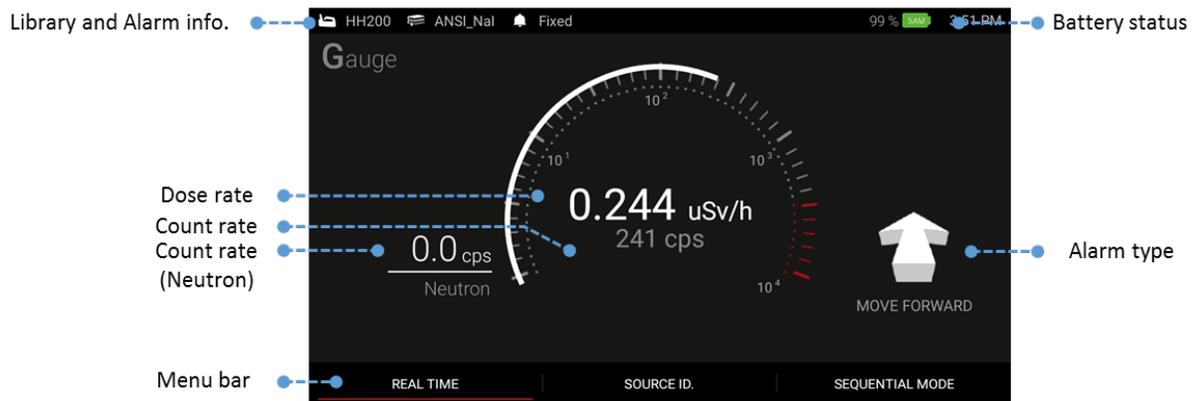

Figure 4.6 Primary GUI description

To access 'Setup' and 'Event log' list, press and hold the [MENU] button on the handle or touch [MENU] icon on the screen. The pop-up menu is appeared as shown in figure 4.7.
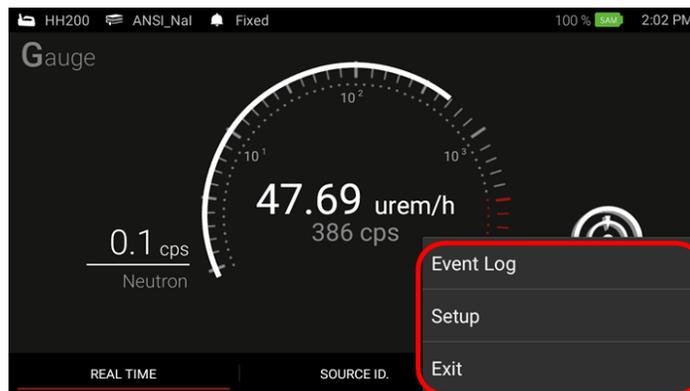

Figure 4.7. Pop-up menu for setup and event log management

CALIBRATION AND BACKGROUND MEASUREMENT

Background / Calibration menu is accessed by touching the setup button (to access the pop-up menu, click and hold the ⌐MENU/⤺ button on the handle or touch MENU /⤺ icon on the PDA screen.).

1. Select "Setup" either by touch on the screen or move curse using the key button on the handle.

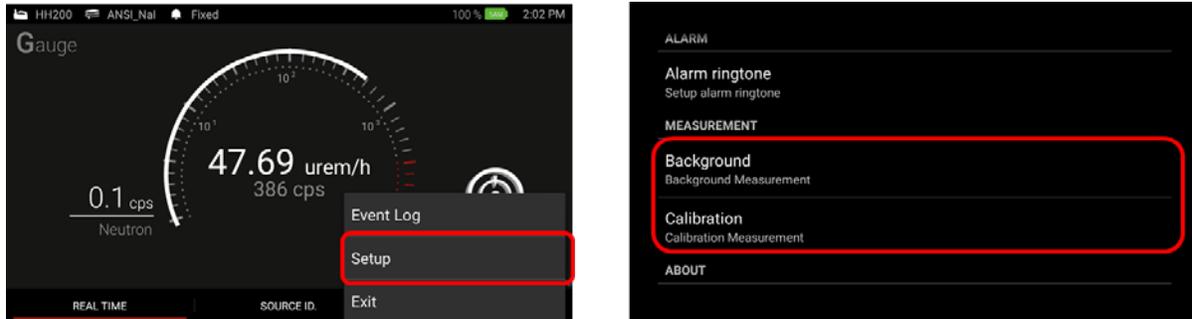2. Select the desired setup procedure. i.e., Background or Calibration

Figure 4.8. Accessing to Background and Calibration menu

3. Calibration: place a calibration source (Cs-137) in front of the detector (minimum 3 inches away from the detector surface) and start calibration. Required counts to terminate the calibration procedure is defined in 'Setup' menu.

Figure 4.9. Energy calibration screen

4. Background measurent: For background measurement, make sure no sources are present during the background measurement procedure. Reguiared background counts to terminate the background measurement procedure is defined in 'Setup' menu.
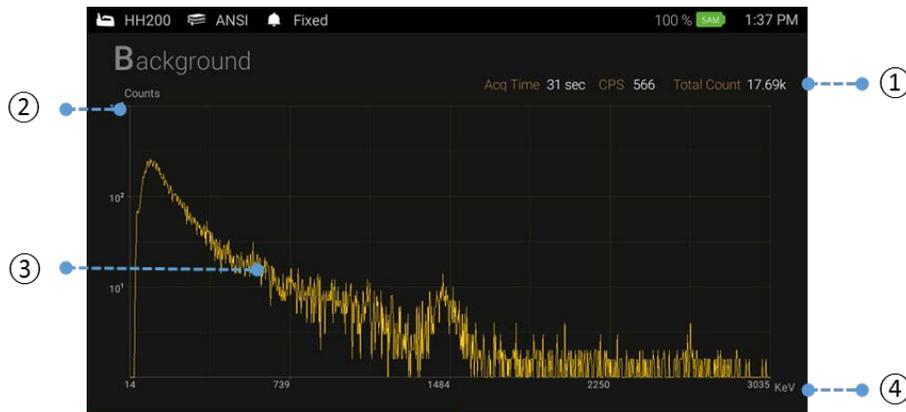
Figure 4.10. Background & Calibration screen information

1	Information	Date/Time, Acq. Time and count rate information
2	Counts	Y-axis unit display (counts in self-adjusting & logarithmic scale)
3	Spectrum	Real time spectrum display
4	Ch/Energy	X-axis unit display (channel or energy in linear scale)

Background measurement is important for accurate nuclide identification. Ensure that no radiation sources are in the vicinity of the SAM 950 during the background measurement.

In calibration mode, place a Cs-137 source front the SAM 950. When the slected number of counts have been acquired, the screen will display "Success". Remove the Cs-137 source when calibration is completed. The x-axis unit change from channel number to energy in keV.

ISOTOPE IDENTIFICATION

Unlike the SAM 945 which triggers isotope identification automatically whenever the count exceed alarm threshold, the SAM 950 can perform isotope identification by manually despite of alarm status. There are three ways to execute 'Manual ID'; 1. Press and hold the [ENTER] 'Enter' key for about 2 seconds, 2. Touch the 'Source ID' menu on the main screen, or 3. Scroll and locate the red bar on the 'manual ID' menu by using left/right button on the handle and press 'Enter' key.

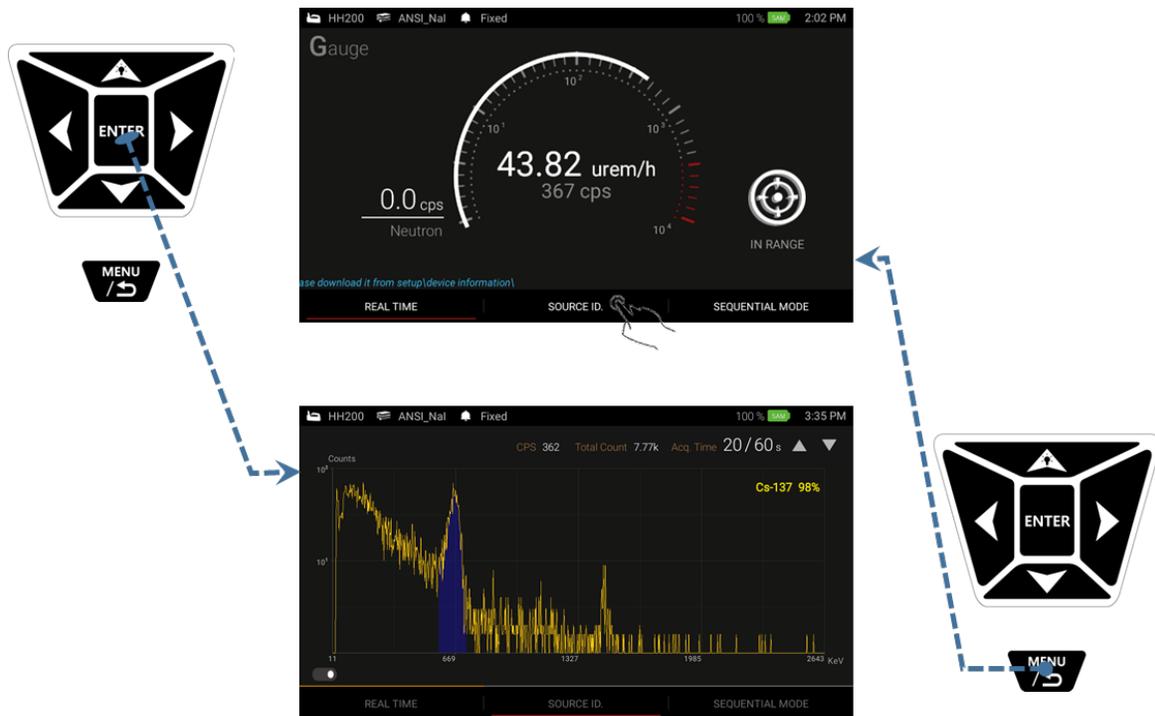Figure 4.11. shows graphical illustration of ways to execute 'Manual ID'.

Figure 4.11. Executing 'Manual ID'

📌 To do programmed and automatic isotope identification, user can select 'Sequential mode' measurement. The sequential mode can be programmable in 'Setup' menu.

📌 The isotope identification result, i.e., 'event log' is automatically saved when the ID is completed. However, unwanted event can be discarded by stopping ID process by pressing 'Back' [MENU] button anytime during manual ID.

✓ **Manual ID screen**

The primary screen is switched to 'Manual ID' screen as shown in figure 4.11 when 'Manual ID' is executed. Spectrum is updated every 1 second and photo-peak area(s) is color coded with candidate isotope information.

The duration of 'Manual ID' is configured in setup menu. The default duration is 30 sec. with 10 sec. increment. However, user can configure the default time and increment by his own preference. Duration can be increased/decreased by increment time using up/down button key on the handle.

Manual ID provides two screens, i.e., spectrum display and analysis screens. They are toggled by swift the screen with a finger (left or right) or left/right button key on the handle.

Click the Back Button( ) will stop 'manual ID' and switch to the main screen. In this case, the event data is discarded.
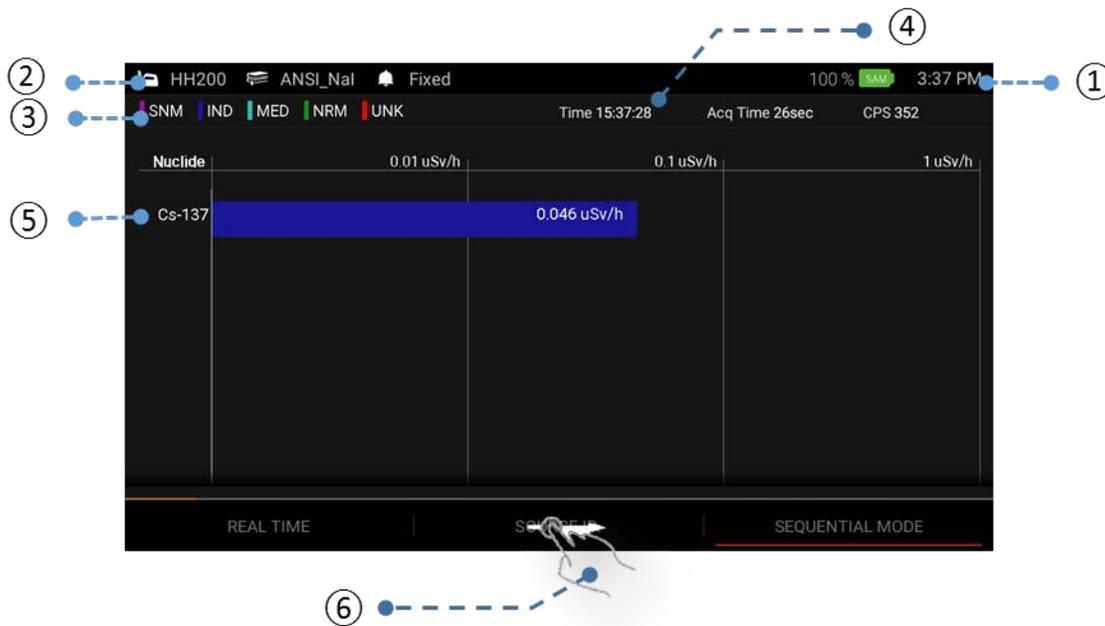

Figure 4.12. Manual ID screen

1	Battery Status	Battery status of SAM 950 unit and time information
2	Library and Alarm	Library and alarm type information
3	ID duration	ID duration and progress. Up/down arrow: increment/decrement ID duration
4	Count info.	Total count and CPS information
5	Counts	Y-axis unit display (counts in self adjusting and logarithm scale)
6	Ch/Energy	X-axis unit display (channel or energy in linear scale)
7	Isotope ID	Isotope ID information
8	Photo Peak	Photo-Peak with color cording
9	Toggle screen	Toggle screen between spectrum display and ID analysis

✓ **Isotope classification screen.**

 The Isotope Classification screen is shown in figure 4.13 below. To access the screen, touch tab menu along the bottom of the Identification screen as shown in figure 4.12, and swipe left or right or press left/right function button ◀ ▶ on the handle.

In this mode, the real-time Dose Rate measurement of identified nuclides is graphically displayed in a horizontally oriented bar graph. If multiple isotopes are identified, SAM III PeakAbout II will place the most significant isotope (highest contributing dose rate) as the top-most bar, and the remaining isotopes in descending order to the least significant isotope (lowest contributing dose rate). Each bar will be named and displayed with the corresponding classification color as shown in figure 4.13.

Figure 4.13. Isotope identification screen

1	Battery Status	Battery status of SAM 950 unit and time information
2	Library and Alarm	Library and alarm type information

3	Classification	Classification of individual isotope(s) identified
		Class of identified isotope
		    SNM: Special Nuclear Material – Magenta
		    IND: Industrial Isotopes – Blue
		    MED: Medical Isotopes – Cyan
		    NRM: Naturally Occurring Radioactive Material – Green
		UNK: Unknown Material – Red

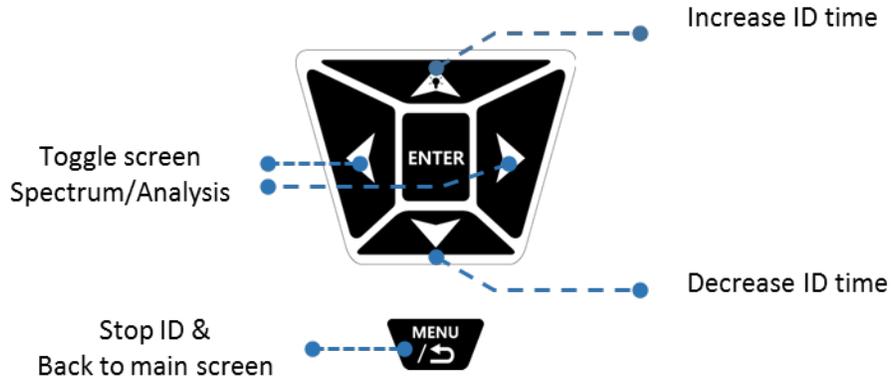| 4	Time/Duration /CPS	Time of ID completion, ID duration and count rate (CPS) information
5	Dose rate	Dose rate of classified isotope (color coded, logarithmic bar graph)
6	Swipe Bar	Swipe left/right on the bar to switch between identification/classification

Function button summary in 'Manual ID' mode

Figure 4.13. Function button summary in 'Manual ID' mode

MANUAL ID RESULT

'Manual ID' result screen is automatically appeared as soon as the ID is completed as shown in figure 4.14. In this screen, the user is allowed to add voice and/or text memo, photo(s) and video(s). The media file(s) are attached into the event log file and saved in the database.

In addition, the event can be immediately send to a desired reach-back and/or third party server such as 'RadResponder'. Refer to the session below for setting up 'Reach-back' and 'RadResponder' account(s).

In order to have 'Reach-back' or 'Third party server' service, the unit has to be in WiFi network connection.
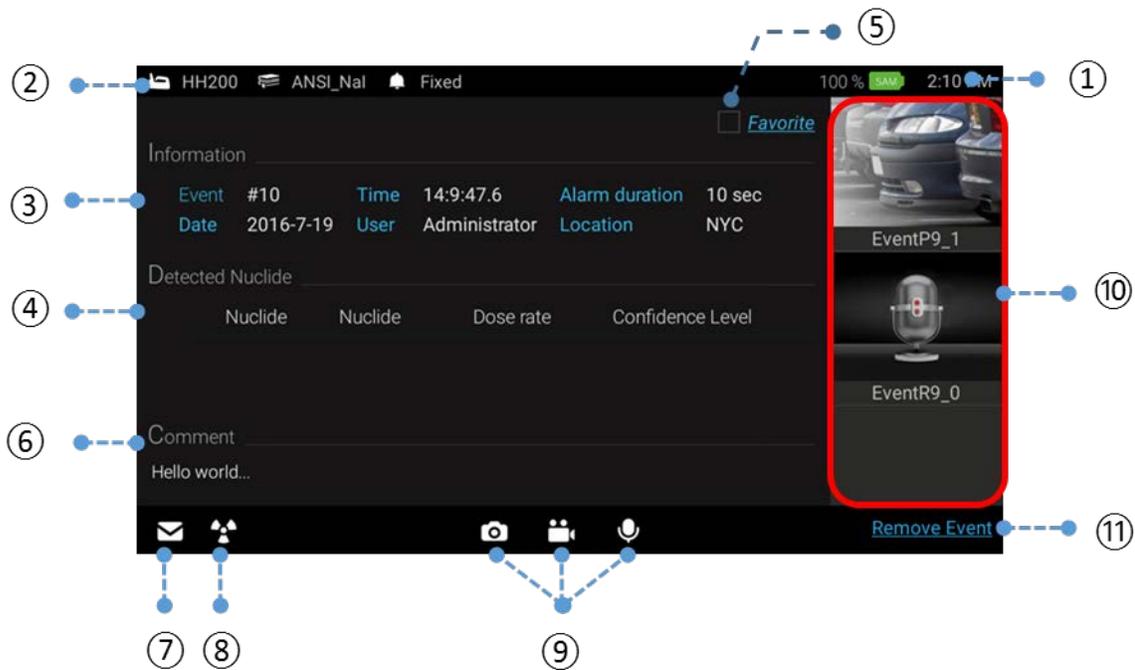
Figure 4.14. Source Identification Result Screen

1	Battery Status	Battery status of SAM 950 unit and time information
2	Library and Alarm	Library and alarm type information
3	Information	General information of event Event: event serial number Date/Time: date and time of event Alarm duration: manual ID duration User: user information Location: event location information
4	Detected Nuclide	Isotope(s) identified
5	Favorite	'Favorite' tag is attached into event file when the box is checked
6	Comment	Type in text comment about the event
7	Reach-Back	Send event file as CVD file to a reach-back center
8	RadResponder	Send event information to 'RadResponder' server
9	Media Record	Take photo(s), Video(s) and voice comment. And attached to the event log file
10	Media List	Preview media files attached and open for review
11	Remove Event	Remove Event

📌 Function button summary in 'Manual ID' mode
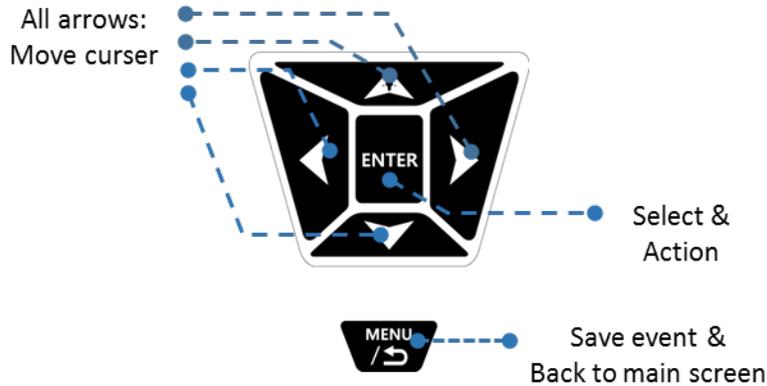
Figure 4.15. Function button summary in 'Manual ID Result' mode

✓ **How to set up Reach-Back**

Reach-back service is performed via WiFi network. The event file is converted into standard N42 file format and send to the 'Reach-back' center via email. To enable 'Reach back' feature, appropriate email account has to be stored.

Following steps show how to set up Reach-back account.

● **Setup email account**

1. Type in information about the sender and receiver's email account information as shown in figure xx. The email account setup menu can be accessed by: Press menu button [MENU] on the main screen → select 'Setup' menu → Administrator → E-mail account.
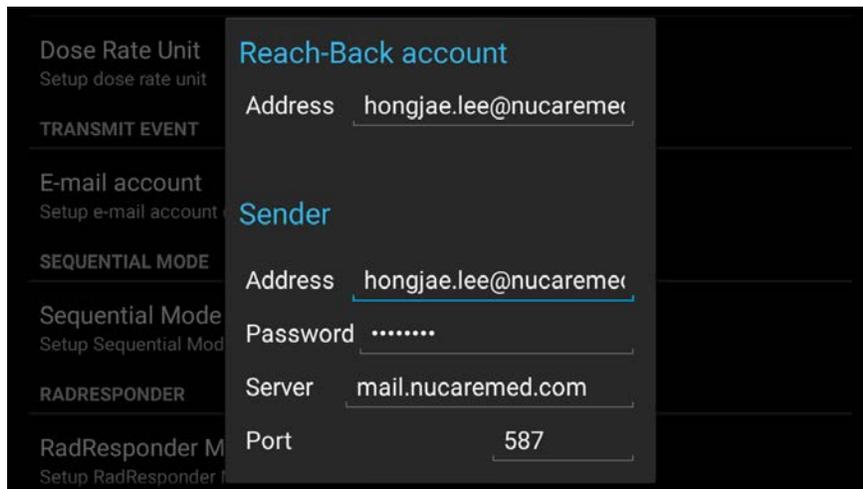
Figure 4.16. Reach-Back account features

✓ **Send event(s) from Event Log to Reach-Back**

User also can send any event(s) stored in Event Log either to Reach-Back center or third party server (RadResponder). Figure xx summarizes procedure.

1. Select event from the Event log list and hold for about 2 seconds.
2. Pop up screen appears as shown in figure 4.17. Select 'Reach-back' as destination to send.
3. Select transmit.
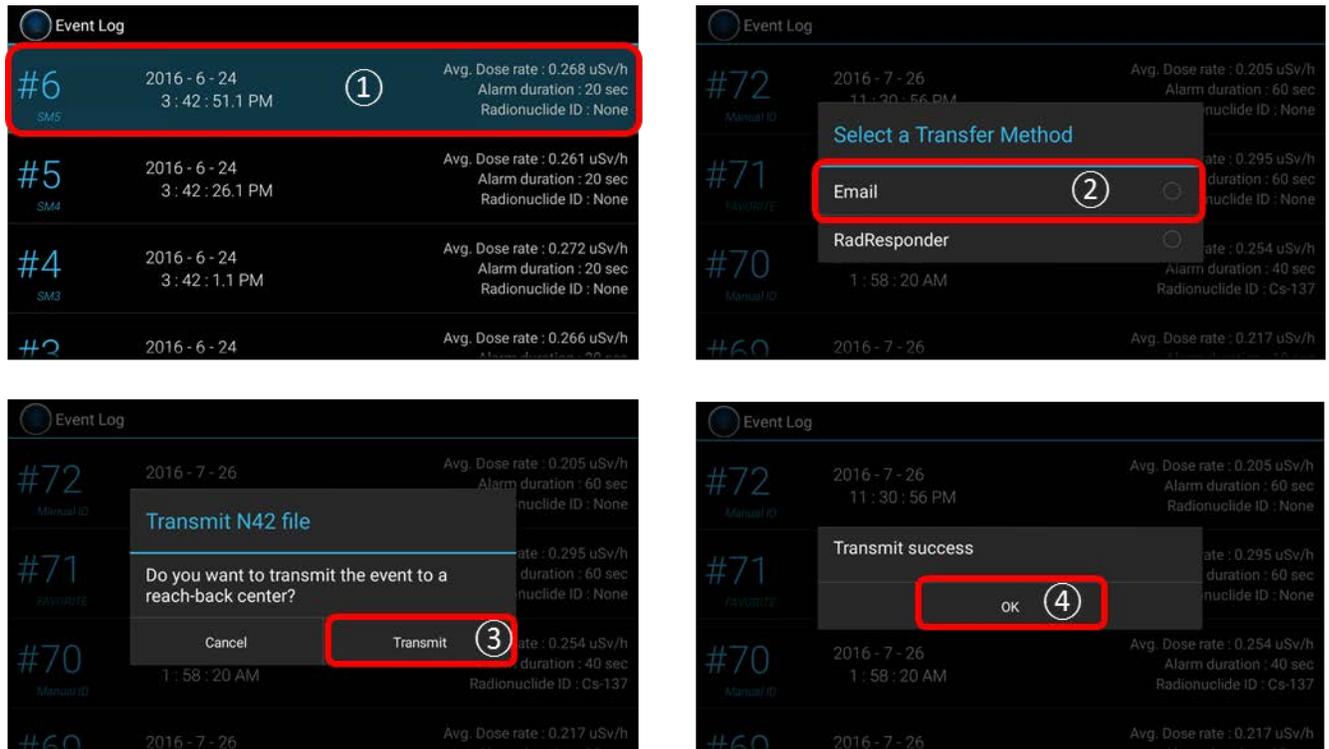
Figure 4.17. Sending event(s) from Event Log to Reach-back.

✓ **Send event(s) from Event Log to RadResponder**

Similar to the Reach-back service, the event(s) can be sent to a server of third party directly.

📌 We have partnered with RadResponder team and setup necessary account and data format to send our event file. For details about RadResponder please visit www.Radresponder.net

Following is steps of using RadResponder feature.

1. Select event from the Event log list and hold for about 2 seconds.
2. Pop up screen appears as shown in figure xx. Select 'RadResponder' as destination to send.
3. Sign in with RadResponder account.
4. Click 'Grant'
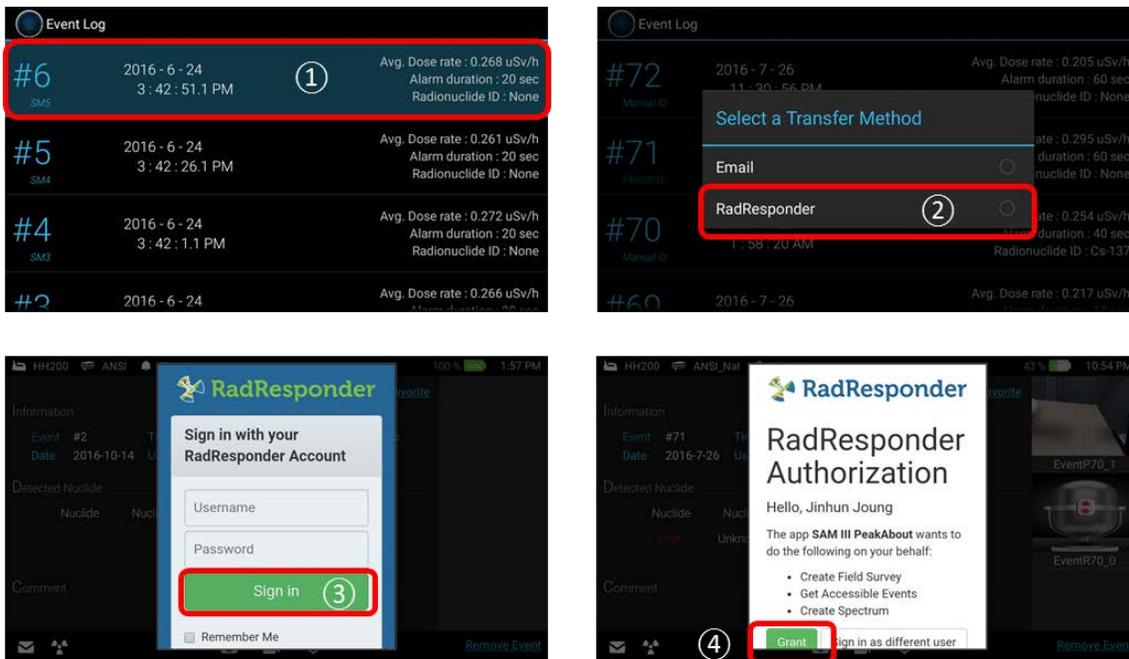
Figure 4.18. Sending event(s) from Event Log to RadResponder.

Validation of file transfer to RadResponder server: User can validate file transfer by examining 'success' tag on the event or visiting RadResponder site (www.radresponder.net: /data/spectra). Figure 4.19 shows examples of successful file transfer.
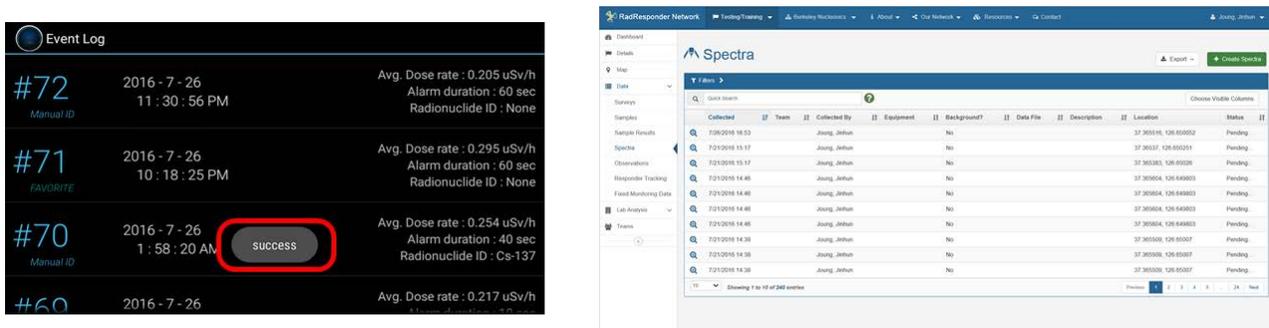

Figure 4.19. Successful transfer validation example.

ATTACH MEDIA FILES

Text and audio comments and/or photo/video may be attached to the opened event.

✓ **Attach text comment procedure (figure 4.20)**

1. Touch Comment area. The keypad and typing window screen appeared.

2. Type in comments and touch "Done" button.
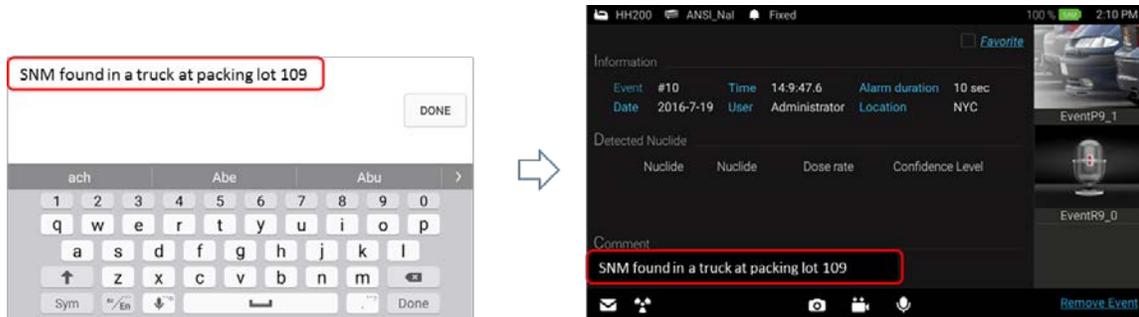
Figure 4.20 Attach text comment procedure

✓ **Attach audio comments/photo/video procedure (figure 4.21)**

1. Touch 'Photo', 'Video', or 'Audio' icon. Selected application is now opened.

2. Take audio comment, photo or video and save.

User can save as many photo/video as needed. The total number of photo/video saved is displayed on the screen.
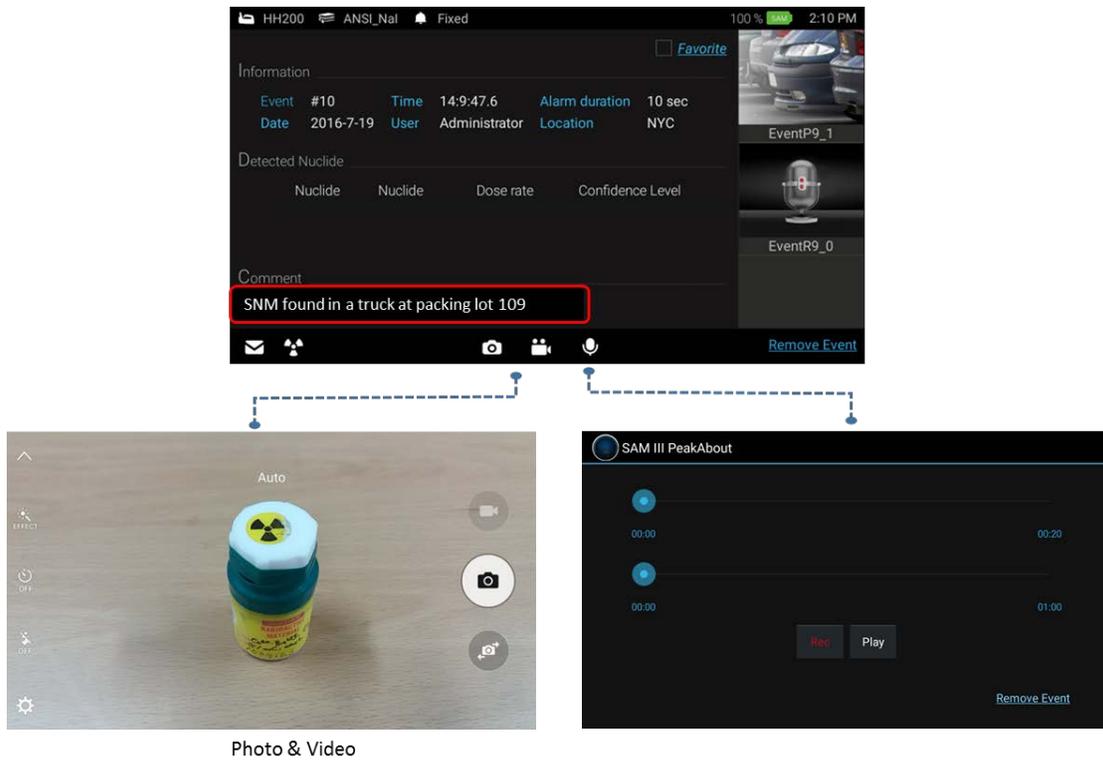
Photo & Video

Figure 4.21. Attaching audio comment, photo and video procedure

SEQUENTIAL MODE OPERATION

SAM 950 provides automatic and programed event log generation. This feature is quite useful when sequential event(s) has to be monitored with long period of time. The 200 unit can be mounted on a tripod for convenience and steady monitoring over long measurement time.

Following is steps to configure sequential mode operation.

1. Press menu button. And select Setup menu.

2. Select 'Sequential Mode'

3. Sequential Mode is optional feature. It can be On/Off by check/uncheck the box as shown in figure 4.22.

4. Setup 'Measurement Time', 'Pause time' and 'Number of Measurement'.

Sequential Mode turn on/off
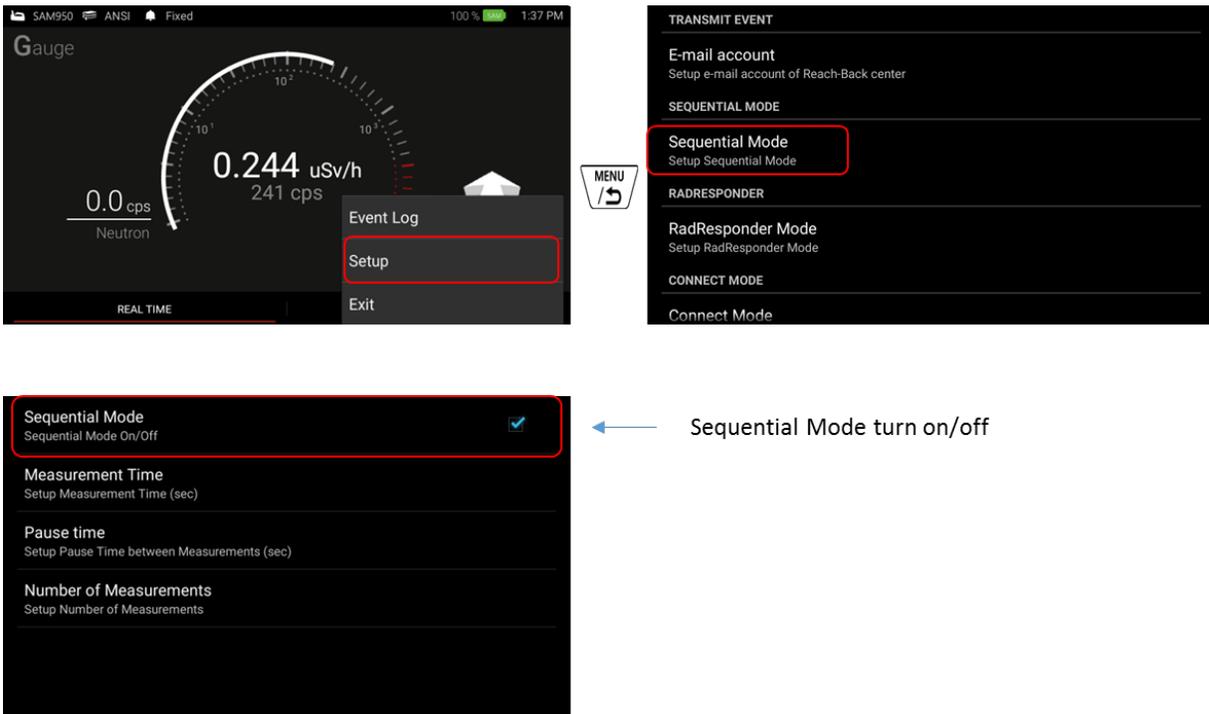
Figure 4.22. Optional Sequential Mode setup example

'SEQUENTIAL MODE' menu tab is created on the bottom of main screen when sequential mode option is turned ON as shown in figure 4.23.
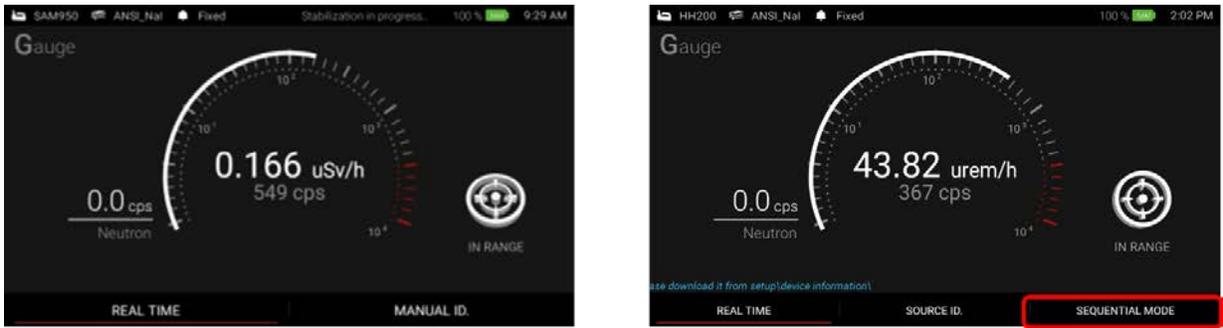
Figure 4.23. Sequential Mode menu tab is created when sequential mode is ON.

FAVORITE EVENT

User can attach a 'FAVORITE' tag to a desired event by check the 'Favorite' box on the 'Event log' screen as shown in figure 4.24. The 'FAVORITE' tag is appeared on the bottom of event number in the event log list as shown in figure 4.24.
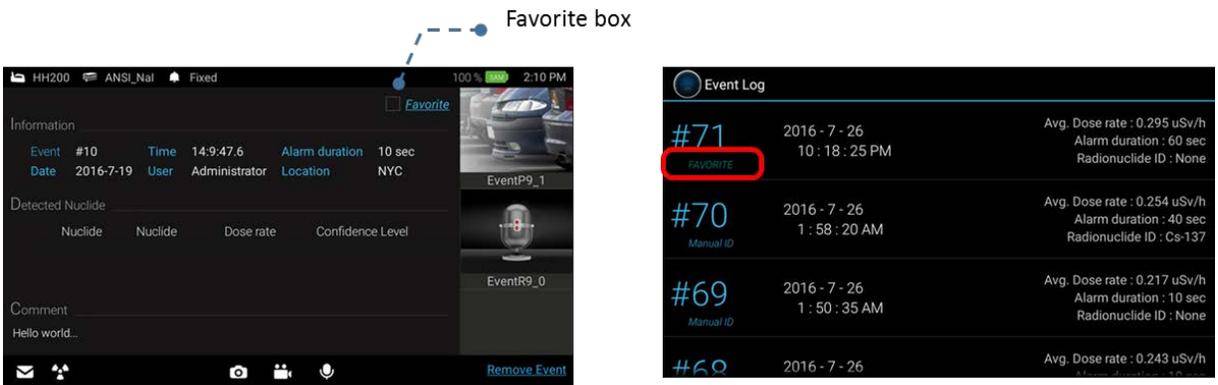

Figure 4.24. Favorite Screen

SPECTRUM MANIPULATION

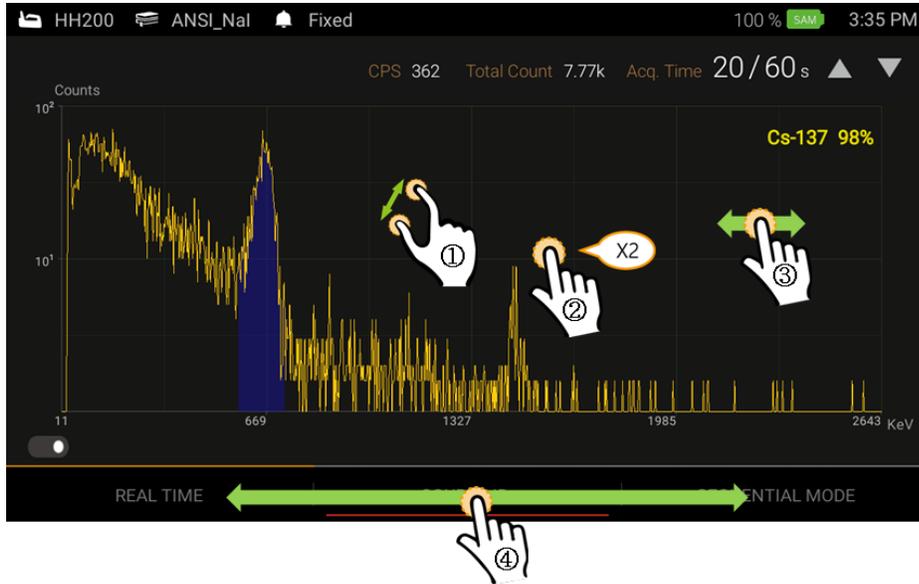Spectrum view manipulation is achieved by touching the PDA display as shown in figure 4.25. below.

Figure 4.25. Spectrum manipulation examples

1	Action	Touch with two fingers and expend or retract	
	Effect	Zoom in/out on a region of interest	
2	Action	Tap twice quickly	
	Effect	Zoom back to the original spectrum scale	
3	Action	Hold and move left/right	
	Effect	Spectrum moves along the x-axis (if display is zoomed in)	
4	Action	Touch/hold on x-axis and move left/right	
	Effect	Initiate a moveable swipe bar to display Real Time and Sequential mede at the touched position	

📌 Y-axis maximum value is automatically adjusted based on the channel with the maximum counts.

CHAPTER 5. OPERATIONAL INSTRUCTIONS

STEP 1. PREPARE THE SAM 950 FOR OPERATION

1. Fully charge the SAM 950 unit
2. Turn power ON. The red LED lamp is turn on.

   Both the SAM 950 unit and imbedded PDA are charged and powered simultaneously.

Figure 5.1. SAM 950 charge and power up example

STEP 2. LOG IN

1. Log in as User or Administrator (password protected).
2. To change password, setup the password as shown in figure 5.2.
3. Setup menu can be access by press menu button( ) on the handle or Touch ( )icon on the touch screen
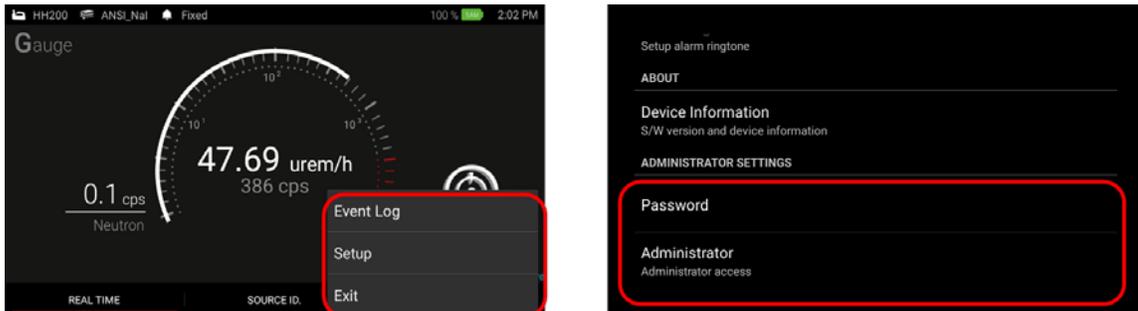
Figure 5.2. login example

Administrator login requires password. Regular user can't access to certain information and/or setup.

Factory setup default password for administrator is '1234'. To change the password, refer to the figure 5.2. It is in 'Device Information/Password' in Setup menu.

STEP 3. AGENT AND SEARCH PLACE INFORMATION

Note: the SAM III PeakAbout software will not start if setup has not been completed.

1. Setup menu can be access by press menu button( ) on the handle or Touch ( )icon on the touch screen
2. Select a 'Setup'.
3. Type in information on the "User Name" and "Search Location" fields
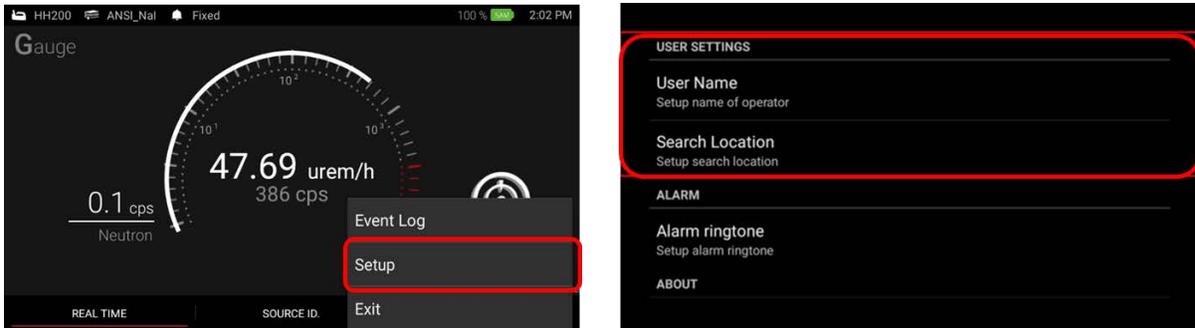
Figure 5.3. Example of access to setup menu

STEP 4. ALARM THRESHOLD

SAM 950 provides two options for alarm triggering described in the following table.

Fixed(Set) Alarm Threshold	Alarm is ON when the count rate exceeds the fixed (set) value. This method is prone to false alarms if the NORM background is fluctuating (usually the case when the system is in motion during search mode)
Variable Alarm Threshold	The threshold value is automatically set according to the statistical fluctuation of the measured background which is updated every 10 seconds. The standard deviation (σ) value is automatically calculated. The threshold value for the background is a multiple of this sigma (σ) value. This multiple is selected during the setup procedure. When the incoming count rate exceeds the threshold value then the system will alarm. This mode is recommended for search mode when the system is in motion and subject, therefore, to fluctuating background.

1. Select 'Set Alarm Mode'. (figure 5.4)
2. Select either "Fixed alarm mode" or "variable alarm mode".
3. Select a fixed count rate value from the 'Fixed alarm mode' menu OR
4. Select a standard deviation (sigma) value from the "Variable alarm mode"

Figure 5.4. Example of Alarm threshold configuration

STEP 5. ALARM RINGTONE

The SAM 950 provides five alarm ringtone options as shown in Figure 5.5. below.

1. Select 'Alarm ringtone' (figure 5.5)
2. Select desired alarm ringtone.
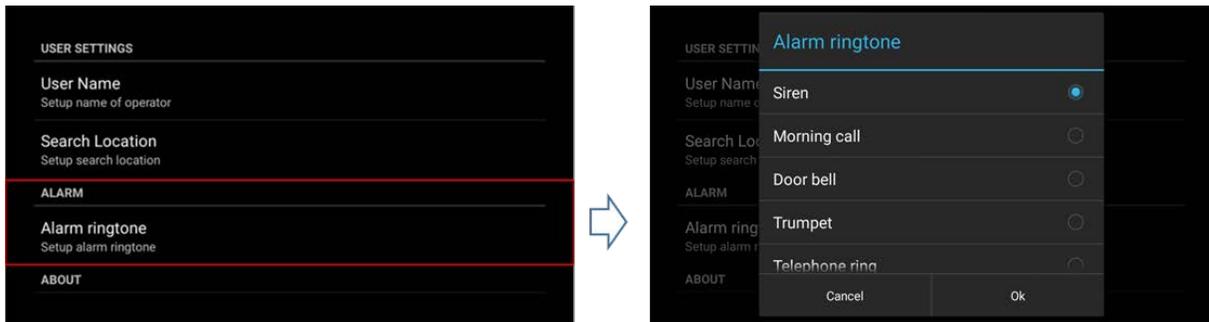3. OK and save the ringtone.

Figure 5.5. Select ringtone

STEP 7.   BACKGROUND MEASUREMENT

Reliable background information is critical for good nuclide identification and alarm performance. The software employs an advanced "NORM Rejection Algorithm" to reduce false alarms due to the fluctuations in the naturally occurring background.

Appropriate background measurement and system calibration of the SAM 950 will ensure that the best possible results are obtained.

1.   Select 'Setup' menu.
2.   Select 'Background' menu.
3.   Measure background information.
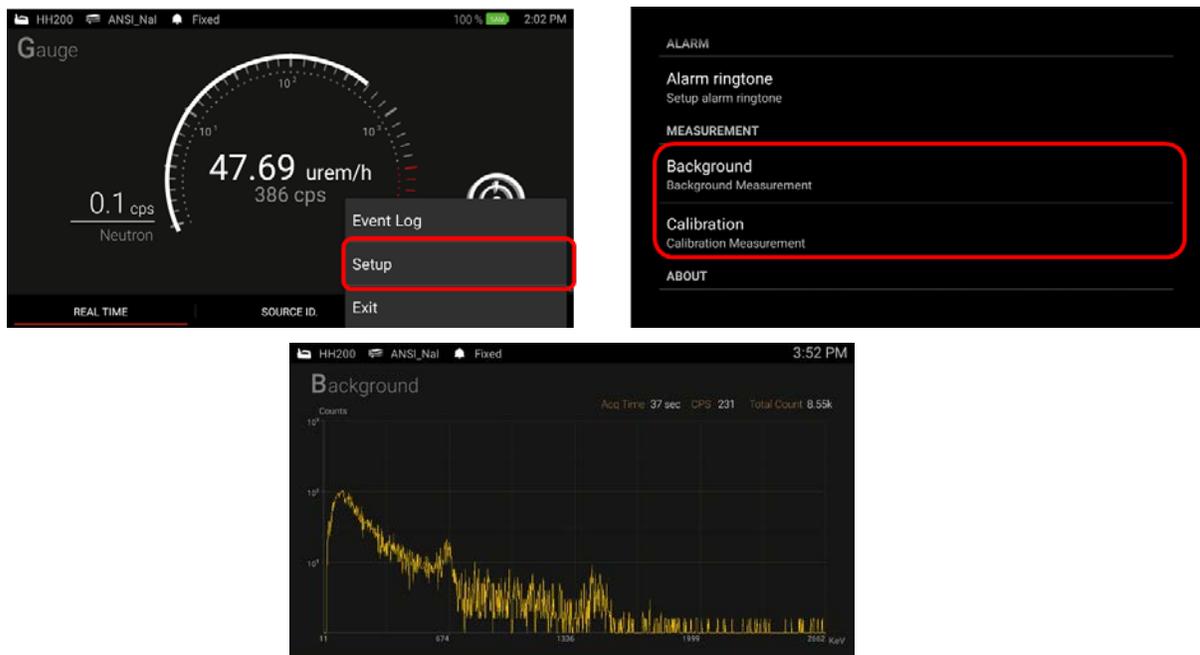
Figure 5.6. Background measurement example

📌 Ensure that no radiation sources are in the vicinity of the SAM 950 during the background measurement.

📌 The background spectrum (displayed in blue) is automatically updated during the measurement. The criteria to determine the background acquisition time are defined in the 'Setup' menu.

STEP 7. ENERGY CALIBRATION

1. Select 'Set up' menu.
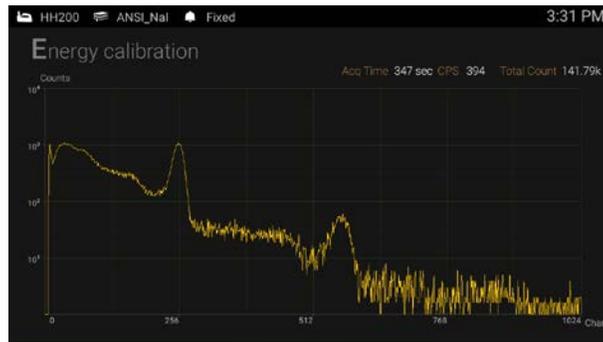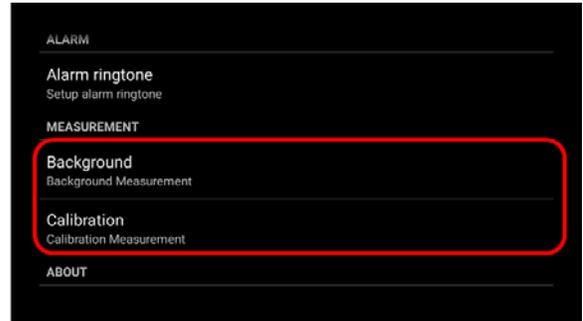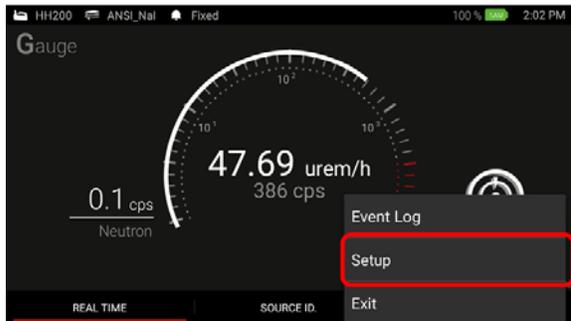2. Place Cs-137 source front to the SAM 950.
3. Select 'Calibration' menu.

Figure 5.7. Calibration example

📌 It is recommended that the total integrated counts in the background spectrum should be not less than 100,000. The total count is defined in the 'Setup' menu.

STEP 8. RADIATION MONITORING

Now the SAM 950 is ready for operation.

1. Gamma activity is displayed in both dose-rate (uSv/h or rem/h) and count rate (cps) units.
2. Figure 5.8 shows the main screen with

If "Variable Threshold" background method is selected, allow the unit to collect background statistics for about 20 seconds before starting radiation monitoring.

Figure 5.8. Primary GUI description

PDA information	PDA status information is displayed in this window. For details, refer to the "Samsung Galaxy Player" manual
Status Information	- Alarm mode: selected threshold method - Library: selected nuclide isotope library - SAM battery: paired SAM 950 battery life indicator - Neutron: 'None' for no neutron detector option. Otherwise, it displays Neutron activity count rate.
Gamma activity display	Gamma activity is displayed in the selected 'dose rate' units.

The default gamma activity unit is uSv/h or mrem/h. It can select a 'Set up' menu.

Several methods have been proposed for the calculation of dose rate using spectral data provided by a NaI(Tl) detector. The SAM 950 employs a method defined by Kwon et.al. [1]

STEP 9. ALARM & ISOTOPE IDENTIFICATION

When the SAM 950 alarms the display changes to red (as shown in figure 5.9) and the alarm audible warning is activated.

Figure 5.9. Alarm Screen

The required nuclides must be in the selected radionuclide library. Refer to 'Nuclide Library Management' session for details of library management.

SAM 950 provides 4 alarm status. Details are summarized in table 5.1.

Table 5.1. Alarm type and its description

Alarm Type	Description
MOVE FORWARD	Activity level is too low to trigger alarm. User has to move forward to activate alarm
MOVE BACK	Activity level is too high. User has to move back for safety
IN RANGE	Appropriate alarm condition. Manual ID can be performed in this range
DANGER	Activity level is extremely high and user has to be evacuate immediately

STEP 10. MANUAL ID

There are three ways to execute 'Manual ID'; 1. Press and hold the [ENTER] 'Enter' key for about 2 seconds, 2. Touch the 'Source ID' menu on the main screen, or 3. Scroll and locate the red bar on the 'manual ID' menu by using left/right button on the handle and press 'Enter' key.

1. Touch the Manual Identification bar and an Event Spectrum will begin immediately.

2. The default capture time for Manual Identification is 30 seconds. You may increase or decrease the capture time by touching the symbols ▲ or ▼ respectively. Default ime is increased or decreased in increments of 10 seconds.

Default capture time and increment can be programmable in Setup menu.

When the capture time has elapsed, the Isotope Identification screen will return to the ID result screen.

Figure 5.10. Source ID Mode

STEP 11. EVENT LOG LIST

The Event Log associated with a 'Manual ID' is automatically generated and saved in the PDA device.

The Event Log screen provides a summary of every alarm event. This data is transferred to the command center software database by connecting the PDA to the command center PC. Once the information is downloaded to the database, the content is automatically deleted on the PDA.

Complete analysis of the spectra for the stored events can be performed with either the PDA or the Command Center SW installed on the Command Center PC.

1. Select 'menu button' (Long Press [MENU/⤺]).
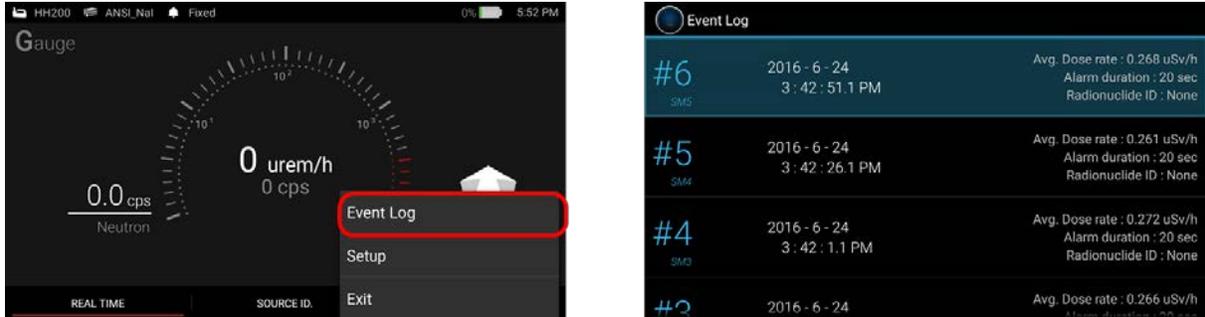2. Select 'Event Log' menu.

Figure 5.11. Example of entering Event log menu

STEP 12. EVENT ID AND INFO

An event spectrum and its associated information can be displayed by touching the event on the list (Figure 2.41). The Event Log screen appears as shown in figure 5.12 below. The Event Log screen consists of 3 tabs, i.e., EVENT ID, EVENT INFO and PHOTO/VIDEO.

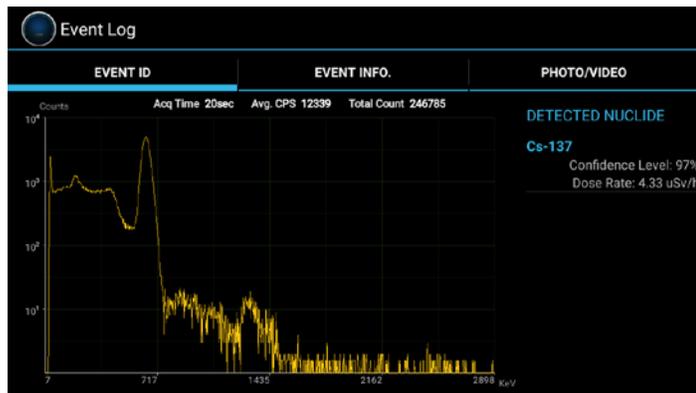Figure 5.12 and 5.13 shows EVENT ID and EVENT INFO screen, respectively.
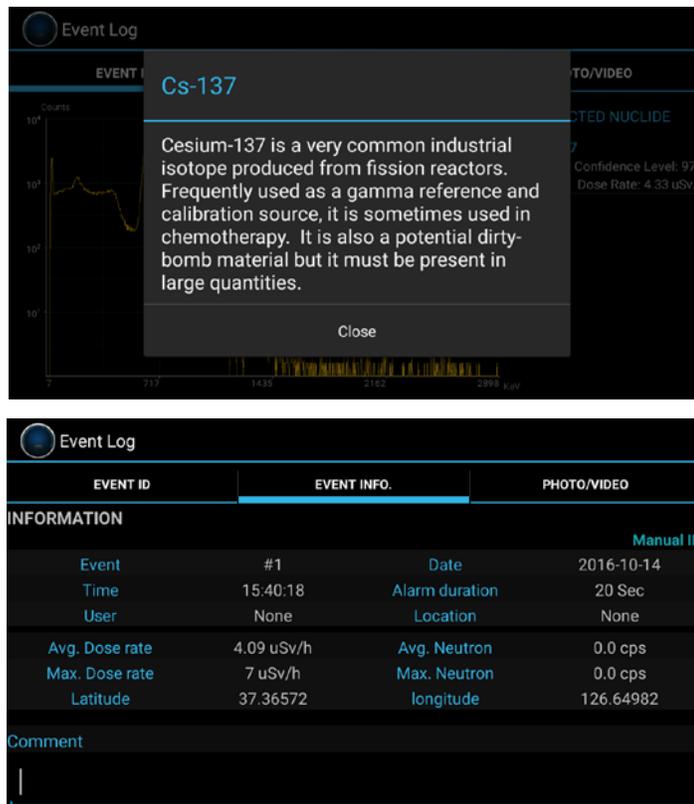

Figure 5.12. Event ID screen

Figure 5.13. Event info screen

General information of any detected nuclide can be displayed by touching a nuclide from the list. A popup "Help screen" is appreaed as shown above figure 5.13.

STEP 13. NOTE AND PHOTO

Text comments and/or photo/video may be attached to the opened event..

'Attach text comment' procedure is shown in figure 5.14.

1. Touch 'EVENT INFO' tab. 'EVENT ID' screen switches to 'EVENT INFO' screen.

2. Touch comment area. The keypad and typing window screen appeared.

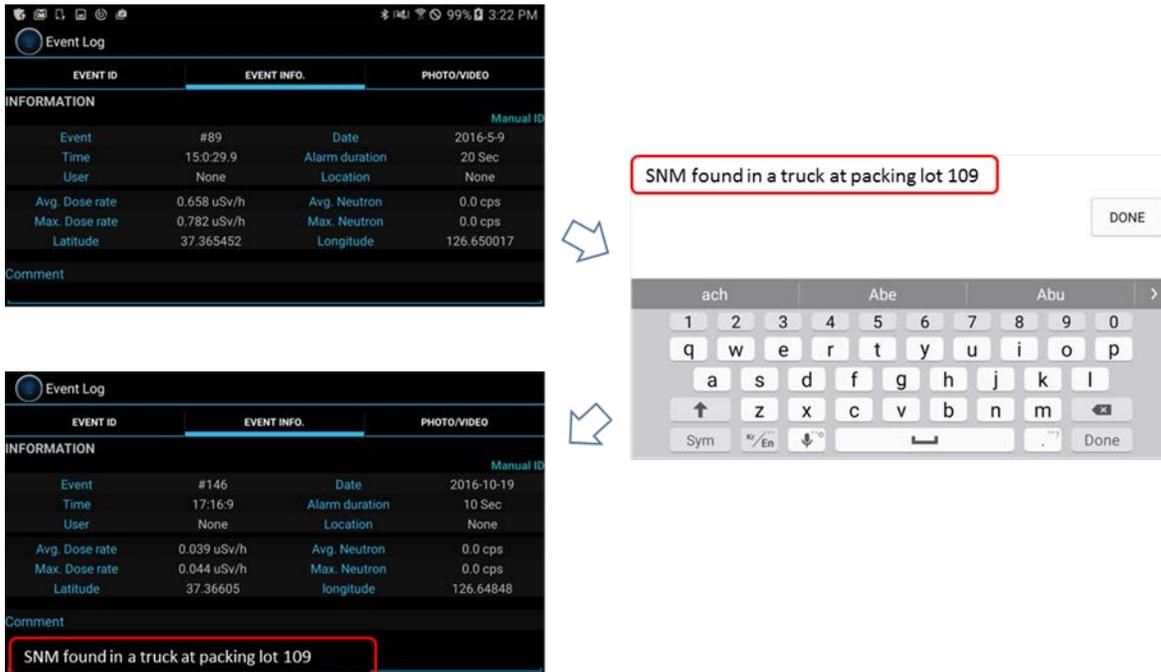3. Type in comments and touch 'Done' button.

Figure 5.14. Attach text comment procedure

'Attach photo / Video / Recorder" procedure is described in figure 5.15

3. Touch "PHOTO/VIDEO /RECORDER" tab.

4. Touch menu key (Long press). Then, Photo/Video /Recorder bar is showed up.

5. Touch "Photo" or "Video" or "Recorder" bar. Photo or Video or Recorder application is now opened.

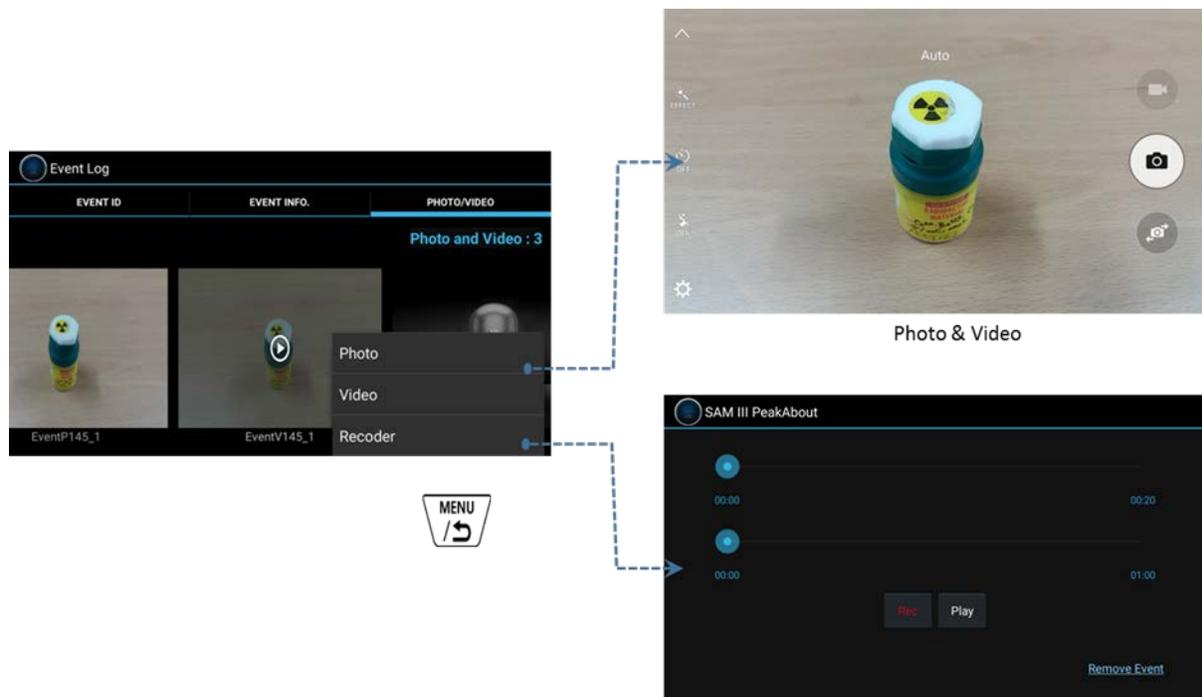6. Take photo or video or recorder and touch "Save" button.

Figure 5.15. Attaching photo procedure

AUTO CALIBRATION AND STABILIZATION

The auto calibration and stabilization feature adjusts the calibration parameters of the system to correct for any drift caused by environmental changes (generally ambient temperature).

Auto calibration is automatically executed when the SAM 950 is powered up (refer to figure 2.45). If user determines to cancel the auto calibration, it can be stop by touch 'Cancel' button. The auto stabilization is executed every 3 minutes unless the unit is in alarm status.

When auto calibration and stabilization is executed the system automatically adjusts its gain using radiation generated by the K-40 radionuclide found in natural potassium. The 1.4 MeV peak from the K-40 nuclide present in naturally occurring potassium is utilized. A calibration source is not needed. KCl powder is already securely installed if it is desired to achieve stabilization in a shorter time, as might be in the rare case of a location where there are unnaturally low levels of potassium. The stopping criteria for this automatic feature are the integrated counts in the K-40 peak. The stopping criteria for this automatic feature is the integrated counts in the K-40 peak. The value for the integrated counts is defined in the setup configuration. Typically 5,000 counts are recommended in order to ensure that the stabilization K-40 peak is well defined.

Supplemental Potassium Chloride (KCL) salt can be used to assist the stabilization if necessary.

If drift of more than $\pm$ 6% between the stabilized peak and the original peak (Cs-137 calibration peak) occurs then re-calibration using a Cs-137 source is required.

When Bluetooth connection is complete, the SAM 950C will typically perform Auto Calibration. It is advised that you wait for Auto Calibration to complete (100%) in order to proceed further, but if your device has been manually calibrated recently, then you may cancel if you wish.
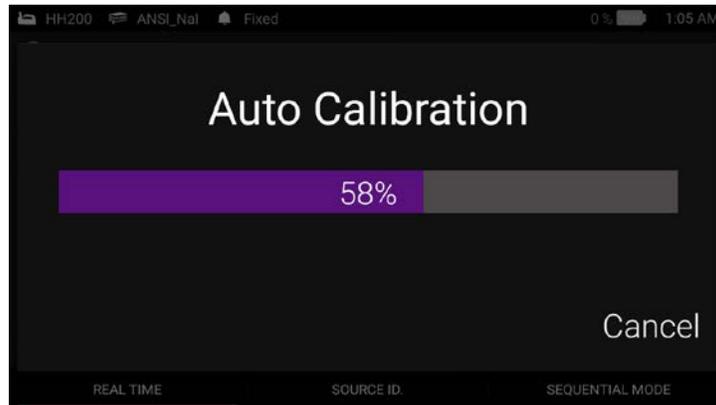

Figure 2.45. Auto Calibration Screen

CHAPTER 6. COMMAND CENTER SOFTWARE

CONNECTION BETWEEN PDA AND PC

Download of the event log data to the command center database is achieved by connecting the PDA to the PC with the provided USB cable. The procedure is detailed below:

1. Exit the PeakAbout software
2. Connect SAM 950 to the PC using a USB cable. The USB port is located on the back of the SAM 950 unit.
3. From PC, open PeakID software.
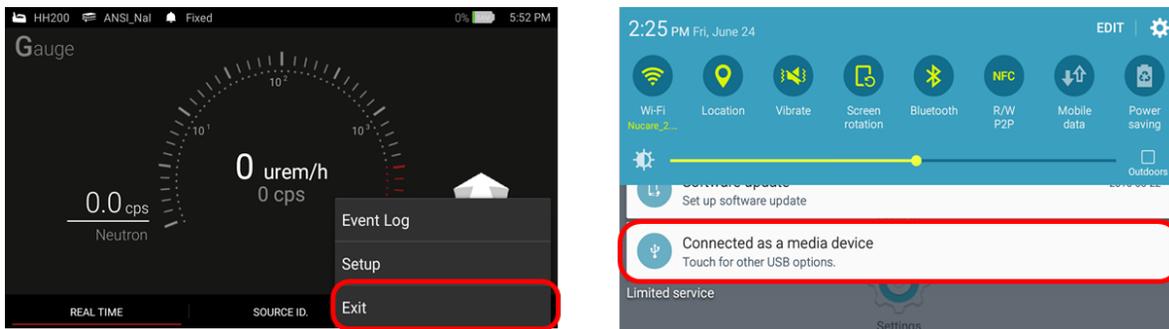4. Refer to the PeakID software chapter for backup/management database.

Figure 6.1. PDA to PC Connection (Typical)

INSTALLATION INSTRUCTIONS

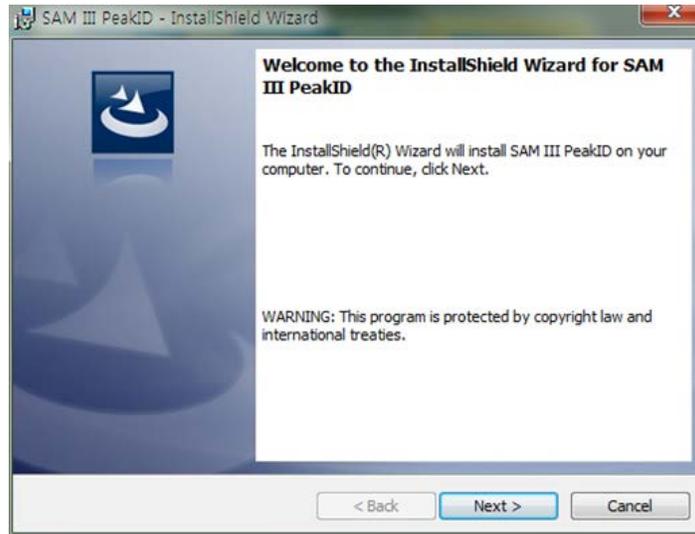Figure 6.2 (a) through (d) describe the installation of the Command Center software.
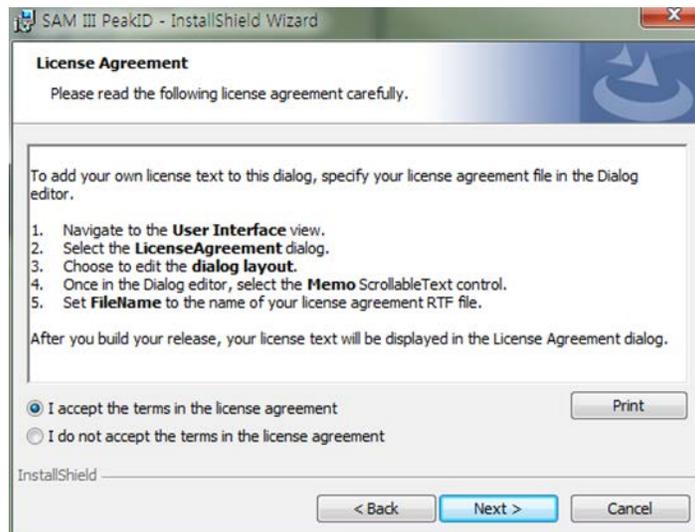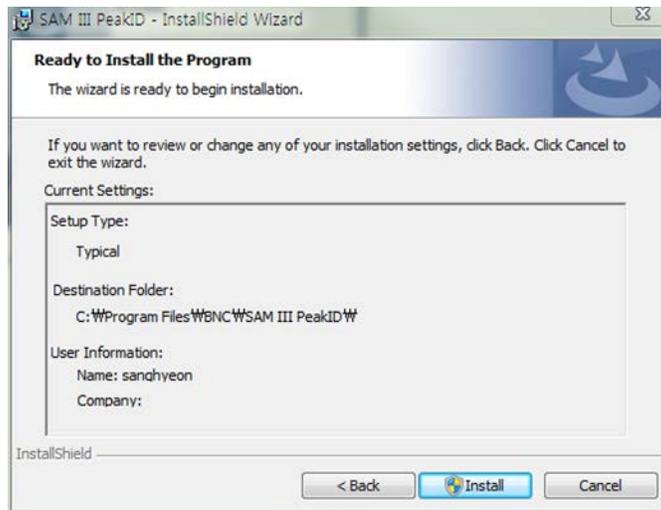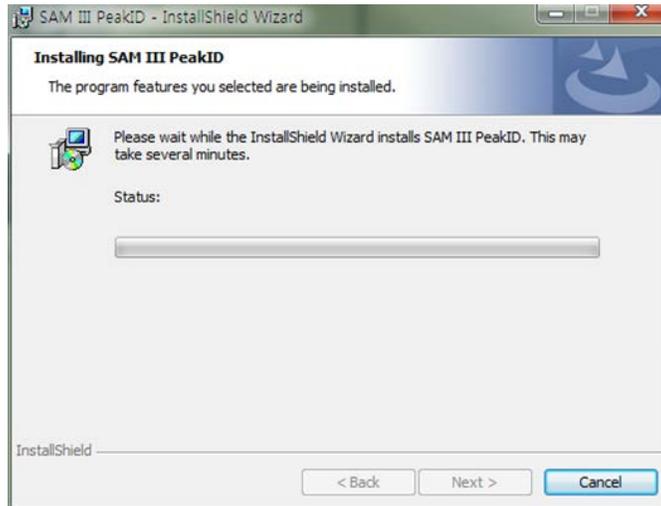
Figure 6.2 (a)

Figure 6.2 (b)

Figure 6.2 (c)

Figure 6.2 (d)

PRIMARY GUI DESCRIPTION

The primary GUI for the command center software is shown in figure 6.3 and described in the table that follows.

Figure 6.3. Primary GUI and its description

1	Database directory	Data can be transferred to the SAM III PeakID program either from PDA or from the database on PC
2	General information	Date, agent, search place and event summary are displayed
3	Event list	List of event log
4	Event Spectrum	Spectrum of selected event
5	Real Time activity	Activity as a function of time
6	Identification	Nuclide identification information of selected event
7	Comments	Attached comments are displayed
8	Nuclide Library	Link to the nuclide library management tool
9	Photos	Attached photos are displayed
10	XML save	Save the file spectrum and report as XML file format

SPECTRUM DISPLAY SCALE

The spectrum can be displayed as either a linear or a logarithmic scale. To switch simply click mouse button in the spectral area.

Figure 6.4 spectrum display change between linear and logarithm scale

RADIONUCLIDE LIBRARY MANAGEMENT

The nuclide library is managed by the command center software installed on the PC. Only administrator can upload built-in library to the PDA. To upload a libray:

1.   Open the nuclide library by clicking the "Isotope Library" button.

2.   Enter Administrator password and login (figure 6.5)

3.   Select library from the list (figure 6.6 left)

4.   Click "Upload to PDA"

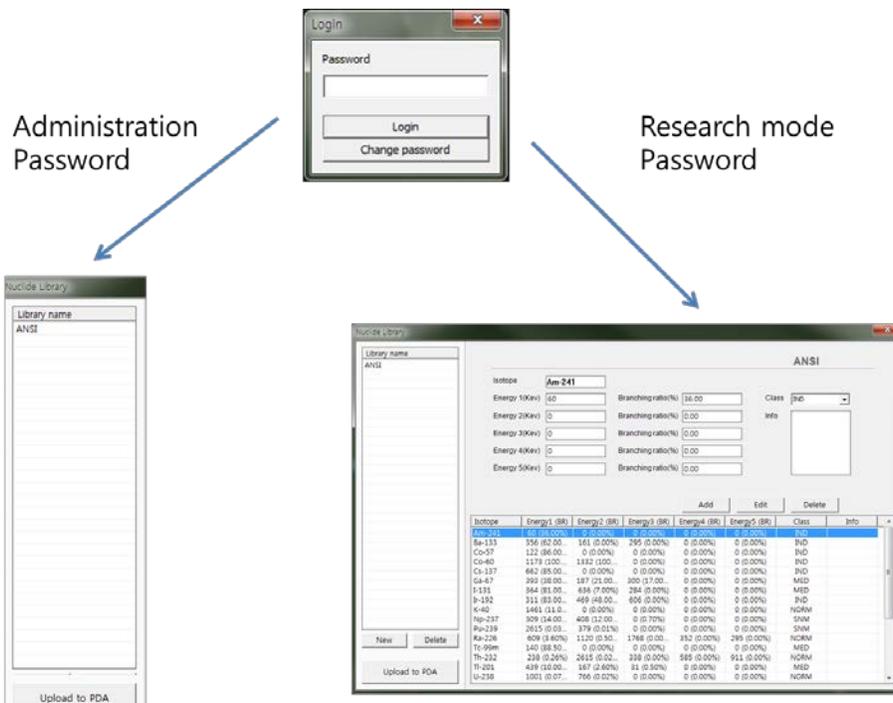

Figure 6.5 Administrator login for uploading library

Figure 6.6 Administrator mode vs. Research mode selection

In research mode only (using factory defined speciall password with instruction) user can add, edit, or delete the library as described below.

1. Open the nuclide library by clicking the "Isotope Library" button. The Nuclide library management screen will appear (figure 6.6 right).

2. Press "New" button to generate new library or select library from the "Library name" list to modify exesting library

3. Add nuclide: type in information for the new nuclide and click the "add" button

4. Edit nuclide: select a nuclide from the list and edit the information as desired

5. Delete nuclide: select a nuclide from the list and click 'delete' button.

6. Upload to PDA: click "Upload to PDA" button.

Table. 6.1. Detectable Idotope List

NORM	K^{40}, Ra^{226} and daughters, Th^{232} and daughters
Medical	F^{18}, Cr^{51}, Ga^{67}, Mo^{99}, Tc^{99m}, Pd^{103}, In^{111}, I^{123}, I^{125}, I^{131}, Xe^{133}, Sm^{153}, Tl^{201}
Industrial	Na^{22}, Co^{57}, Co^{60}, Se^{75}, Rh^{106}, I^{132}, I^{133}, Ba^{133}, Cs^{134}, Cs^{137}, Eu^{152}, Ir^{192}, Am^{241}
SNM	U^{233}, U^{235}, U^{238}, Pu^{239}, Pu^{241}, Np^{237}

XML FILE (ANSI42.42) CONVERSION

The spectrum in the event log can be saved in the standard ANSI42.42 XML file format. The procedure for saving such a file is described below.

1. Select the event from the event list and click the disk icon(⊞) in the lower left corner of the screen. The destination directory screen will appear (figure 6.6 below).

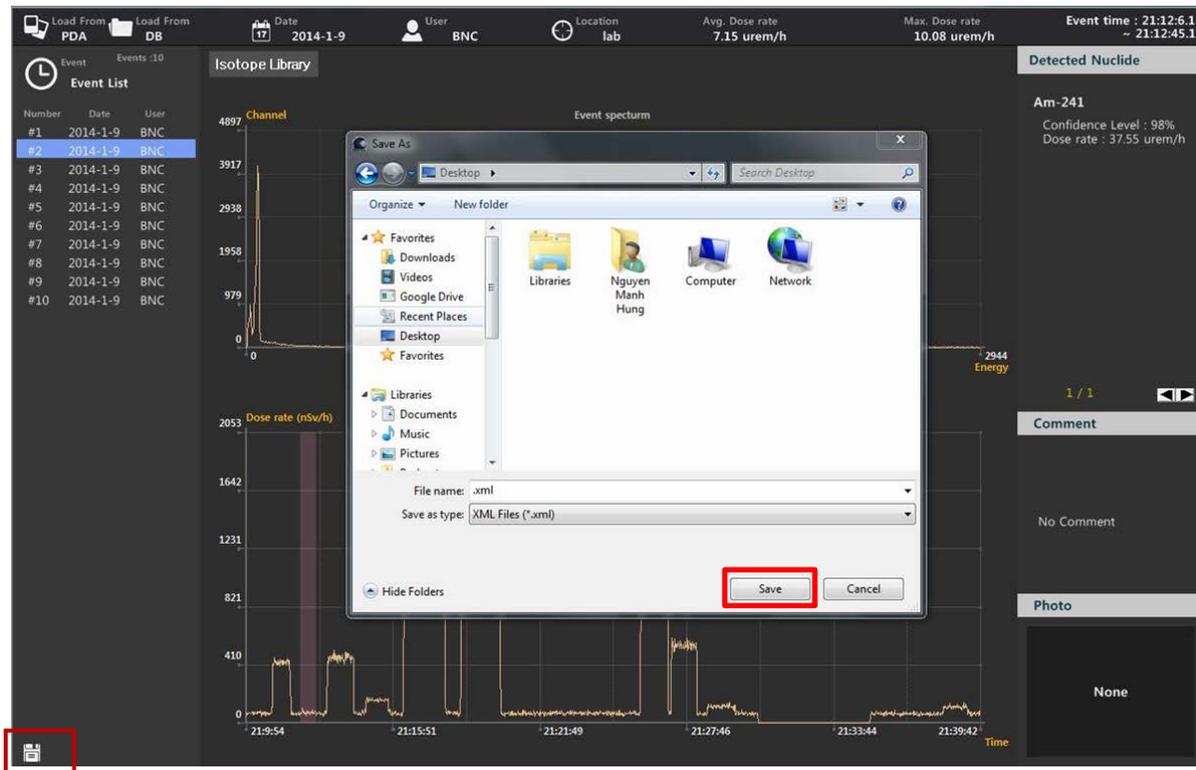2. Browse to, then select the desired directory and click "Save".

Figure 6.6. Save as XML file format example

STEP BY STEP INSTRUCTION FOR COMMAND CENTER SW OPERATION

Step 1. Event log download from PDA to PC

1. Open 'SAM III PeakID' software.
2. Click "Load from PDA".
3. The event log now download and the event list is displayed on the "event list" window.
4. Select an event on the list. The spectrum is displayed on the "Event Spectrum" window.
5. Time and duration of the selected event are highlighted on the "Real time activity" window.
6. Nuclide identification information for the selected event is displayed in the "Detected Nuclide" window.
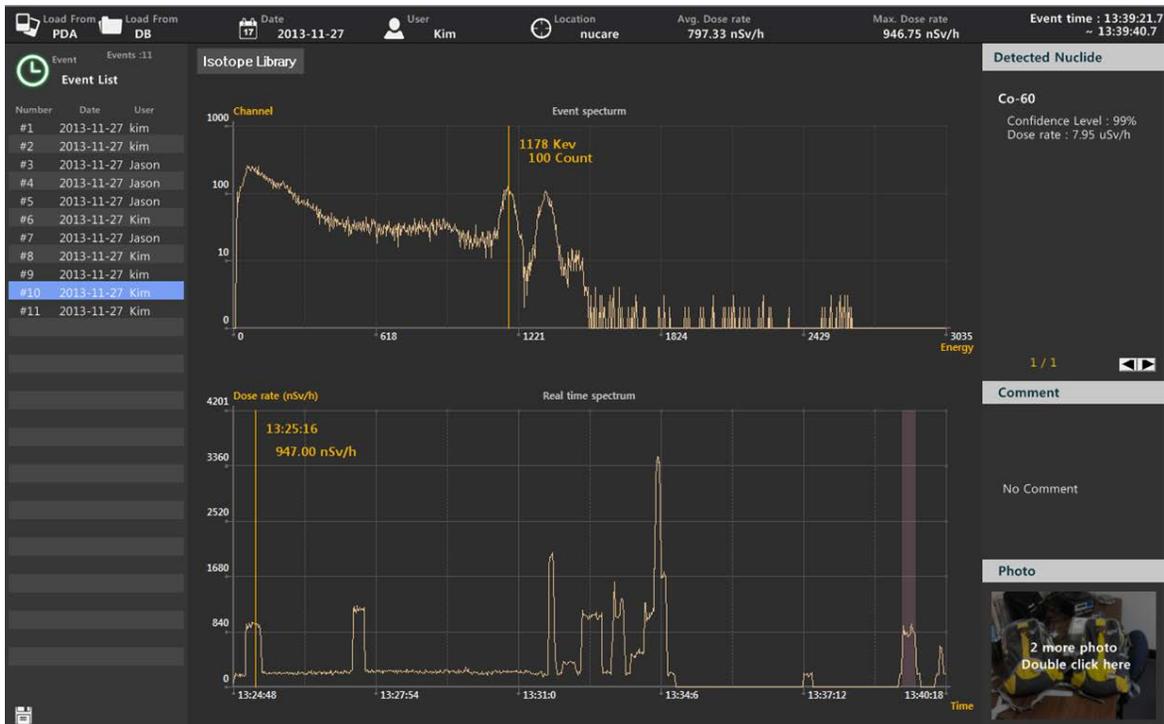

Figure 6.7. Event log download from PDA to PC

The command center software automatically downloads the event log information to the event log database and deletes the event log from the PDA.

Step 2. Event analysis from the database

All the events collected from multiple PC100C units may be stored in a single database and managed by the command center software.

Display and analysis of the events in the database do not require that a PDA is connected to the PC.

1. Click "Load from DB". The database folder information popup appears (figure 5.9 below).

2. Click on the folder of interest. Sub-folders are sorted according to connected SAM 950 devices.

3. Select the sub-folder for the desired SAM 950 unit.

4. The list of event(s) for the selected folder is displayed in the "Event list" window.

5. Select the desired event from the list. The spectrum will appear in the "Event Spectrum" window.

6. The time of day and acquisition time are highlighted in the "Real time activity window".
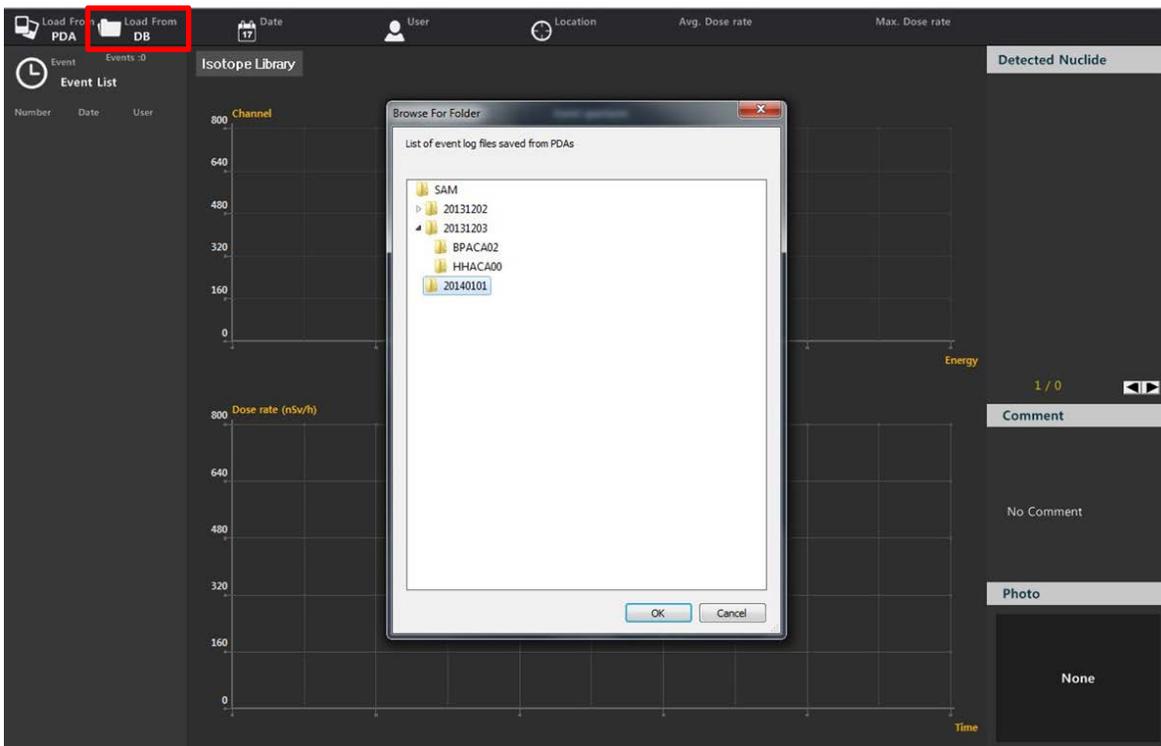

Figure 6.8. Event log download from database

To delete folder or sub-folder, select folder of interest and right click on mouse. And select delete command.

Event Database contains folders and subfolders named by event dates and unit name, respectively.

CHAPTER 7. REMINDER AND USUFUL TIPS

✓ Do not open the cover. The servicing of the unit should only be handled by BNC qualified/trained personnel.
✓ Do not connect the PDA to the PC (USB cable) while the PDA-SAM 950 is in operating status
✓ Turn off unnecessary PDA applications to optimize the performance of PDA-SAM 950 communication and operation.
✓ Be familiar with the PDA operation. Please refer to the Samsung Galexy Player user manual.