RSI RADIATION SOLUTIONS INC

RS-350 Backpack Detector User Manual

INSTALLATION AND OPERATOR

Revision 1.13.2 – November 2024

RadMobile App Android Software Version 1.5.12

RadMobile App iOS Software Version 1.3.3

Part Number D-1184

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Revision History			
Date	**Revision**	**ECO #**	**Description**
Mar 21, 2017	00.01	NA	DRAFT – Preliminary - Android Sw v1.3.1
April 18, 2017	00.09	NA	Preliminary Release - Android Sw v1.3.2
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June 29, 2018	01.01	165	Document Overhaul
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May 07, 2019	01.04	190	Update manual to reflect Android Sw v1.5.12
Sep 08, 2020	01.05	241	Document Overhaul
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Oct 01, 2021	01.07	278	Document Overhaul
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Aug 29, 2022	01.09	313	Added Appendix A – FCC Regulations and Labelling
Nov 23, 2022	01.10	326	Updated manual to reflect software android OS version 1.4.7
Feb 27, 2023	01.11	331	Document Overhaul – Added iOS version
May 05, 2023	01.12	333	Document Overhaul Changes to Entire Document
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Nov 08, 2024	01.13.1	NA	Update to FCC/ISED Statement
Nov 20, 2024	01.13.2	NA	Picture update

Product Manual - Disclaimers:

Due to our efforts to continuously improve this product, specifications, dimensions, operating features, and procedures described in this manual are subject to frequent changes. The printed version of this manual reflects only the configuration current at the time of printing. The most current version of the manual is provided in electronic format on the Product Support CD supplied with the instrument. Please refer to the electronic version of the manual for the most accurate interpretation.

RSI RADIATION SOLUTIONS INC

CONFIDENTIAL DISCLOSURE

USERS ARE HEREBY NOTIFIED THAT THIS MANUAL CONTAINS TECHNICAL INFORMATION OF A PROPRIETARY NATURE. THIS INFORMATION IS NECESSARY FOR TECHNICALLY KNOWLEDGEABLE USERS TO UNDERSTAND SYSTEM OPERATION AND TO SATISFY THEMSELVES THAT THE SYSTEM IS PERFORMING CORRECTLY.

RADIATION SOLUTIONS INC ACCEPTS THAT IT IS THE RIGHT OF SUCH USERS TO BE PRIVY TO THIS INFORMATION. HOWEVER, THIS DOCUMENTATION IS PROVIDED SOLELY FOR THE BENEFIT OF OWNERS OF THE RSI STEEL BACKPACK DETECTOR SYSTEM AND DISSEMINATION OF THE DETAILED TECHNICAL INFORMATION PROVIDED MAY BE CONSIDERED AS LEGALLY CONTRAVENING THE NORMAL SUPPLIER/CUSTOMER RELATIONSHIP.

UNAUTHORIZED RELEASE OF DETAILED TECHNICAL INFORMATION TO A THIRD PARTY WILL BE CONSIDERED AS A CONTRAVENTION OF USER AGREEMENTS.

Manufactured by Radiation Solutions Inc., 5875 Whittle Road, Mississauga, Ontario, Canada, L4Z 2H4

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System Configuration:

External Acquisition Device: Android OS or iPhone iOS

Acquisition Device Software:
- RadMobile Android App v1.5.12
- RadMobile iOS App v1.3.3

RS-350 G2 Firmware v1.34.12.0
RadAssist Software v6.2.60.0

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1.0 INTRODUCTION

1.1 General

A new type of mobile detector has been designed by RSI to be carried inside a backpack. This detector will communicate wirelessly with the operator to provide radioactive measurement information. The detector can be used with an external acquisition device that has the RadMobile App loaded onto it. A tablet running Windows 11 and RSI proprietary software (*RadAssist*) can also be used to analyze the spectral data. The **Radiation Solutions** model **RS-350 Backpack** is a human portable radiation detector for gamma and neutron detection and identification with built-in GPS. Designed for first responder and law enforcement applications, the RS-350 Backpack is a rugged, self-contained, fast deployable system that exceeds ANSI N42.53 Standards.

1.2 Acronyms

The following acronyms are used throughout this manual:

Hardware	**CPU**	Computer Processing Unit
	DPA	Divider Preamp Assembly
	NaI	Sodium Iodide (Detector)
	Li-ION	Lithium Ion (Battery)
	XTAL	Crystal
File Extensions	**SBL**	Stabilizing Log
	EVL	Event Log
	RFL	Radiation File Log
Parameters	**DOCH**	Data Output Channel
	LINT	Linearization Table
	OOR	Out of Range
Connections	**AUX**	Auxiliary
	RJ45	Ethernet Connector
	BT	Bluetooth
General Names	**RSI**	Radiation Solutions Inc.
	APP	Application (Acquisition Device)

1.3 RS-350 Backpack Detector System Features and Specs

1. **RSI Proprietary:**

   Fast and accurate radiation detection, Nuclide ID, and dose rate with high throughput and essentially zero Dead-Time.

2. **State-of-the-Art Backpack Detector Design:**

   A battery-operated wireless communicating detector, designed to be rugged enough to withstand the impact forces and environmental conditions that it will encounter from being carried inside a backpack on exploration of rugged terrain.

3. **Communication (Connections – Bluetooth, Wi-Fi, and Wi-Fi Hotspots):**

   An External Acquisition Device App was created to communicate through Bluetooth or Wi-Fi to the backpack detector. The app is able to run on acquisition devices or tablets that display the detectors information. The external acquisition device is provided with the detector system.

4. **Power Consumption**

   Power consumption ranges from 6 watts for the basic system and 7 watts for a fully loaded system, providing the user with up to 20 hours of battery life on a 10Ah battery.

5. **Battery Pack:**

   Li-Ion Battery Pack – **P-1699** – 12V 10Ah Battery – LiFePO4

   Li-Ion Battery Pack – **P-2457** – 12V 7Ah Battery – LiFePO4 (shipping friendly)

   Battery Charger – **C-1323** – Li-ION 12V 4A SP-12V4-CHP

   The unit can operate for 10 hours between battery charges *(2 hr. charge time)*. The RadMobile App will show the condition of the battery charge. Hot-swappable batteries ensure extended operation time and seamless operation between battery swaps.

6. **Temperature Range:**

   -50 to +50°C – Storage Temperature

   -40°C to +50°C – Operating Temperature

7. **Rating:**

   The military grade backpack system is rugged and weatherproof; IP55 rated.

8. **Detector:**

   P-2011 – 3 x 3 NaI Xtal Assembly – **(QTY x 2 for RS-350 (A-1184))**

OPTIONAL: 2x4 NaI, LaBr 3x3, CsI 3x3

   P-1021 – 9” He-3 Tube Neutron Detector Assembly – **(QTY x 4 for RS-350 (A-1184))**

9. Software: RadMobile App, RadAssist, RadView, MapAssist

10. Connection: Bluetooth, Wi-Fi, Wi-Fi Hotspot

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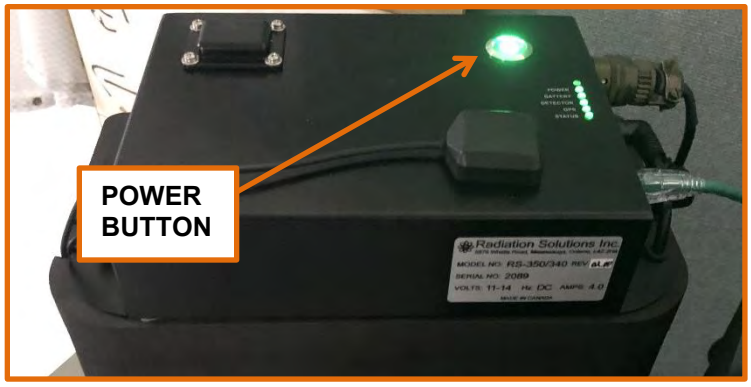
2.0 INSTALLATION

2.1 Startup

A **POWER** button is located on the RS-350 *(shown to the right)* to turn the system **ON** or **OFF**.



2.2 Connections

Front Panel Controls and External Connections:

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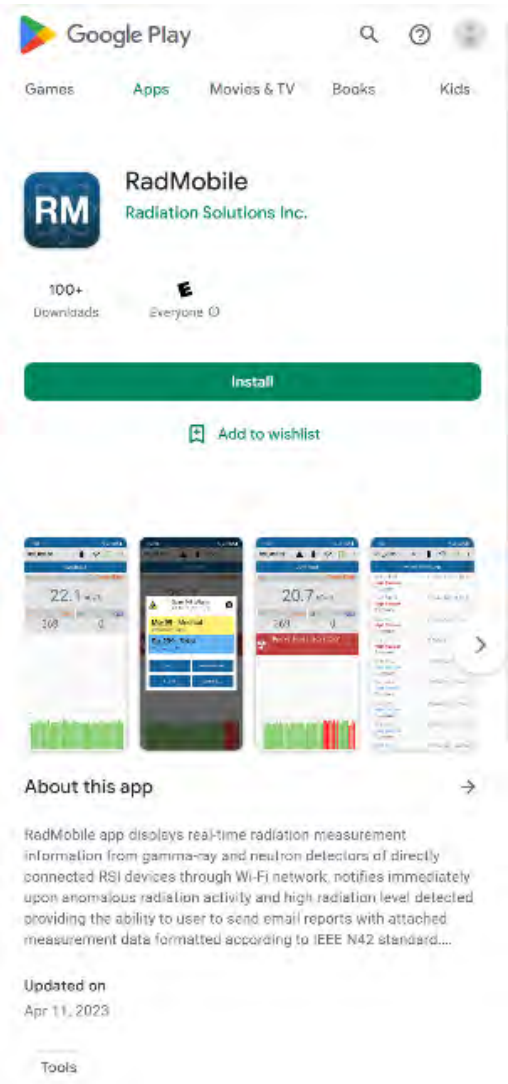
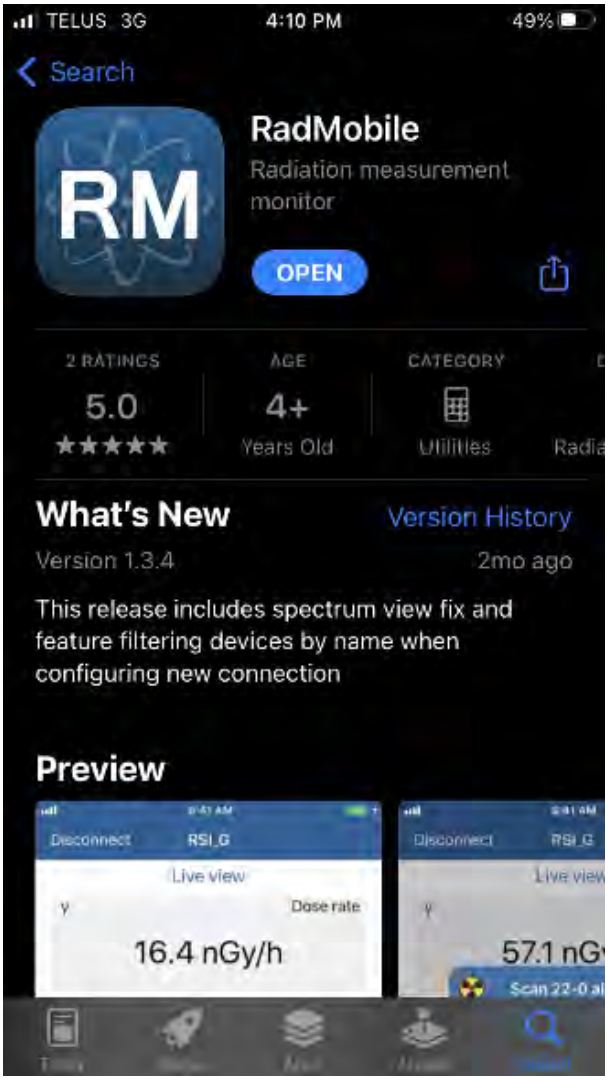
3.0 RADMOBILE APP

3.1 Getting the RadMobile App

To download the **RadMobile App** for **Android**, go to the **Google Play Store**, type RadMobile *(one word)* into the search bar, and click **Install**. For **iOS** users, go to the **App Store**, type **RadMobile** *(one word)* into the search bar, and click **Get**. Both versions are shown below.



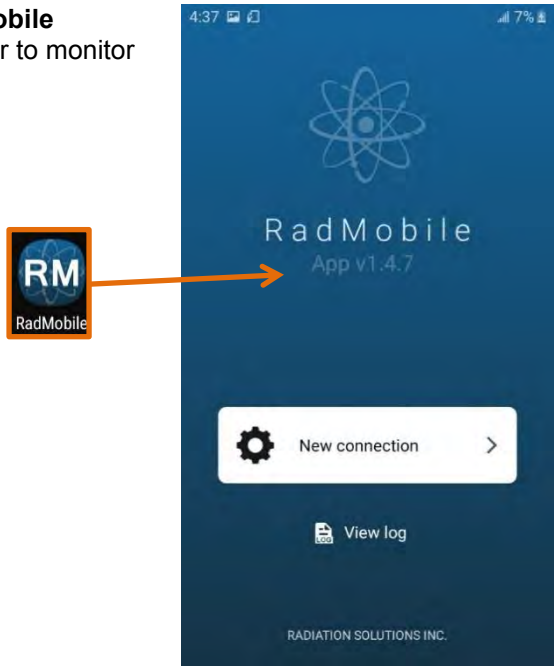


iOS Version

3.2 Home Screen Startup

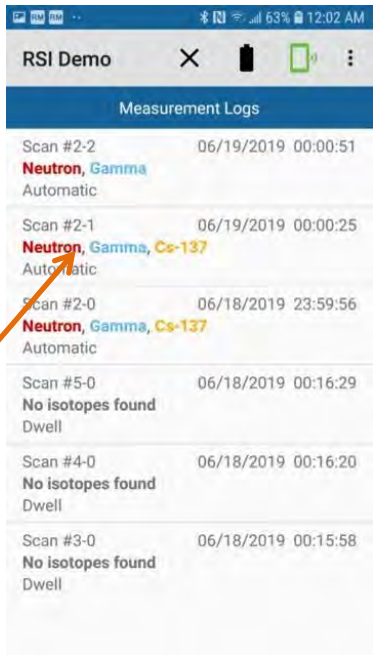
This Chapter describes how to operate equipment with the **RadMobile Application** and what portions of the app are used by the operator to monitor system activity and respond to various alarms.

Use the RadMobile icon to open RadMobile.



The **View Log** button opens the **Measurement Logs** which displays a history of past alarm events as shown to the right.

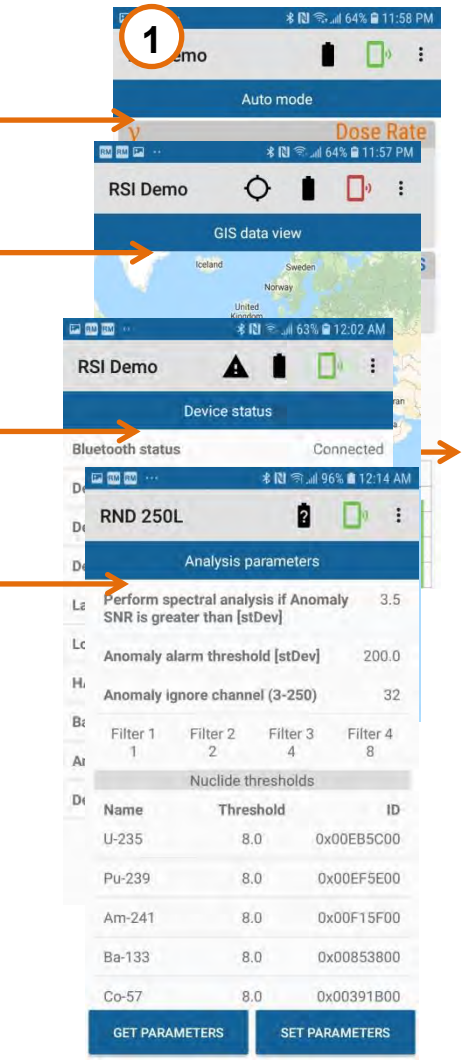
RadMobile Alarm Log Files

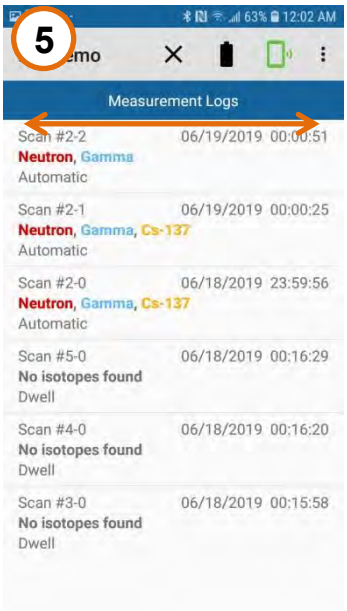


NOTE: The information provided within this manual is the same for both Android and iOS versions of the RadMobile App. Differences between the two versions will be clearly noted where applicable.

3.3 RadMobile Application Pages

The operator can horizontally scroll across the following **FIVE** pages:





SWIPE TO GO BETWEEN PAGES

NOTE: Android version displayed, iOS application pages look and function the same.

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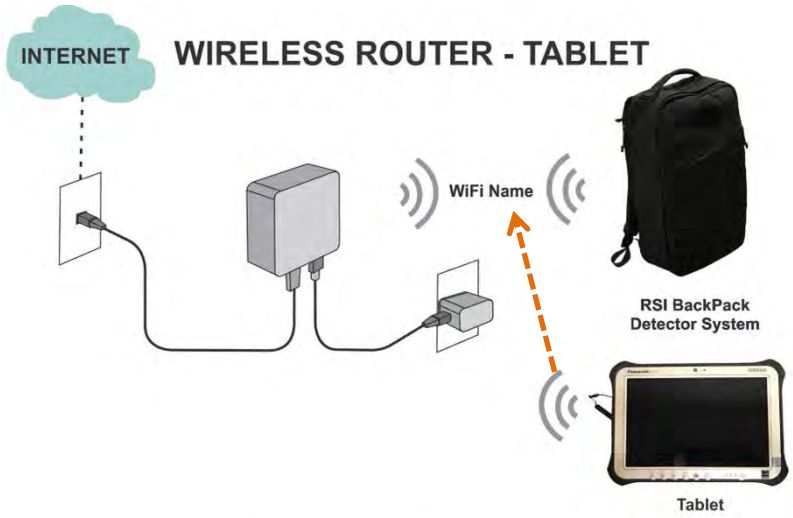
4.0 DEVICE CONNECTIONS

4.1 Device Connection Options

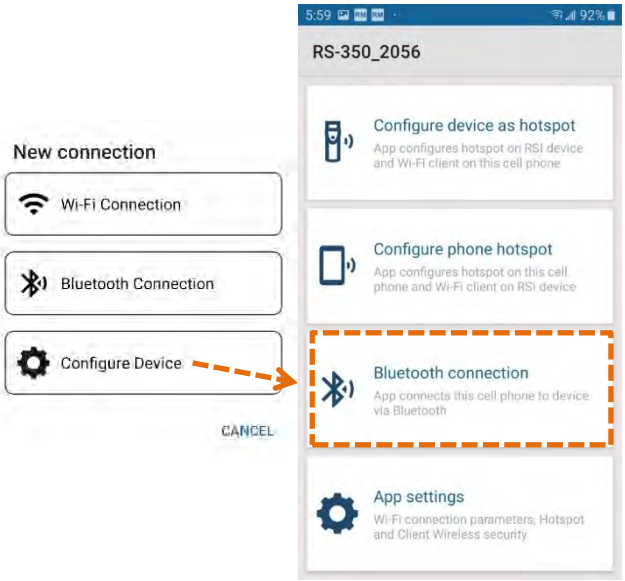


Follow the instructions included with the router of your choice. When the router configuration is complete refer to the Sections below to connect to the device wirelessly.

4.2 BackPack Connection to RadMobile

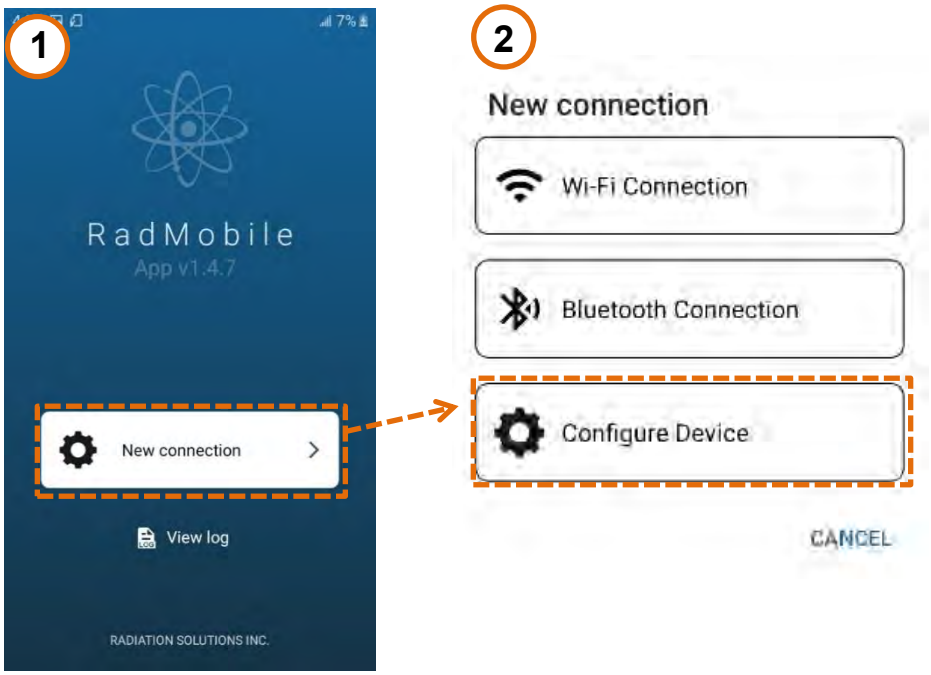
4.2.1 Bluetooth Connection

A. Android



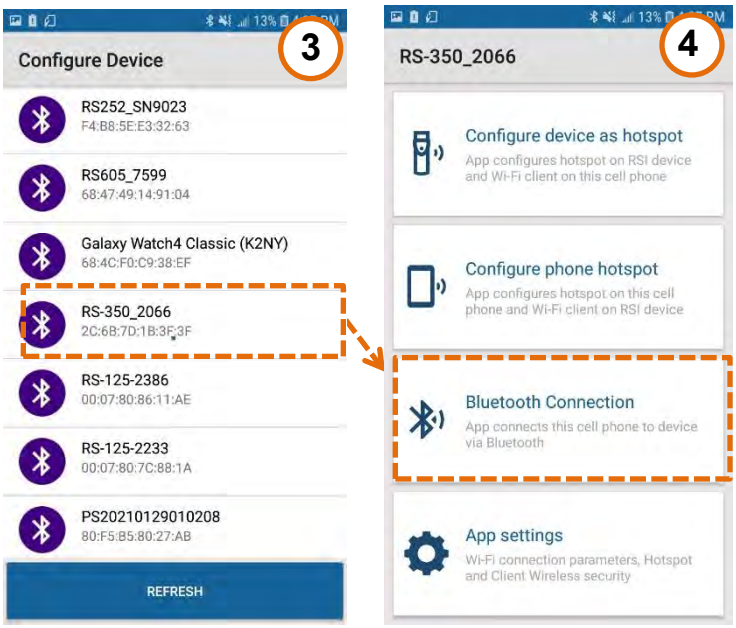
A. Establish a Bluetooth Connection – Android (First Connection)

1. The **RadMobile Application** opens. Touch the **New Connection** button as shown to the right.
2. A pop-up window opens with three options for selection. Touch the **Configure Device** button as shown to the right.



3. The **Configure Device** list opens with a list of all available devices for connection in the area. Select the required system based on the serial number.

4. Select **Bluetooth Connection**.



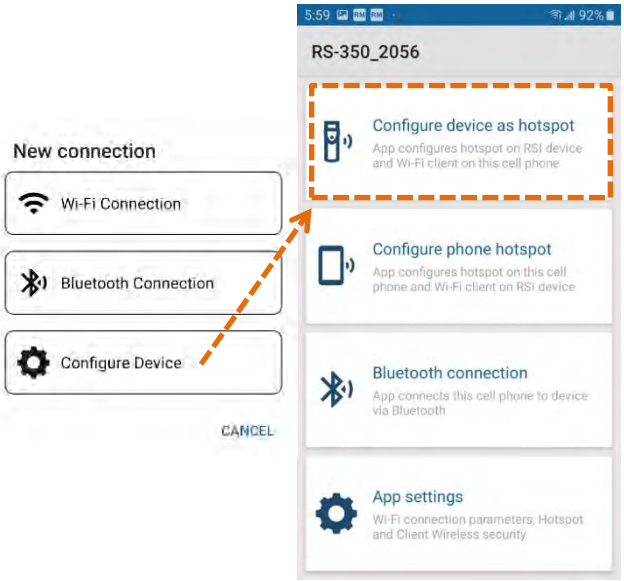
5. The backpack system and phone will begin connecting and initially displays a splash screen. After a successful connection, the app will automatically open to the Auto Mode page as shown below.

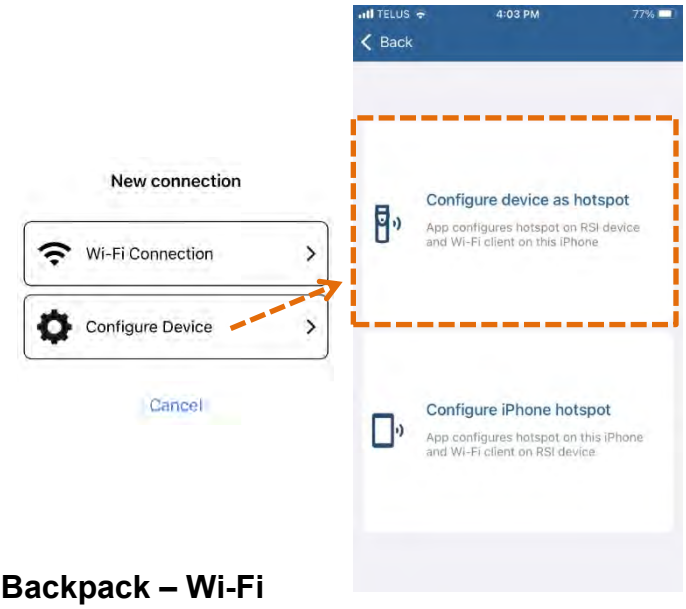
NOTE: Disconnecting after using the **Bluetooth Connection** from the **New Connectio**n menu *(shown to the left)* will cause the app to forget the system. If the user would like to have a system that can be Bluetooth connected instantly from the Home Screen, use the **Configure Device** procedure as detailed above.

4.2.2 RSI Backpack – Wi-Fi Hotspot (First Connection)

A. Android

B. iOS

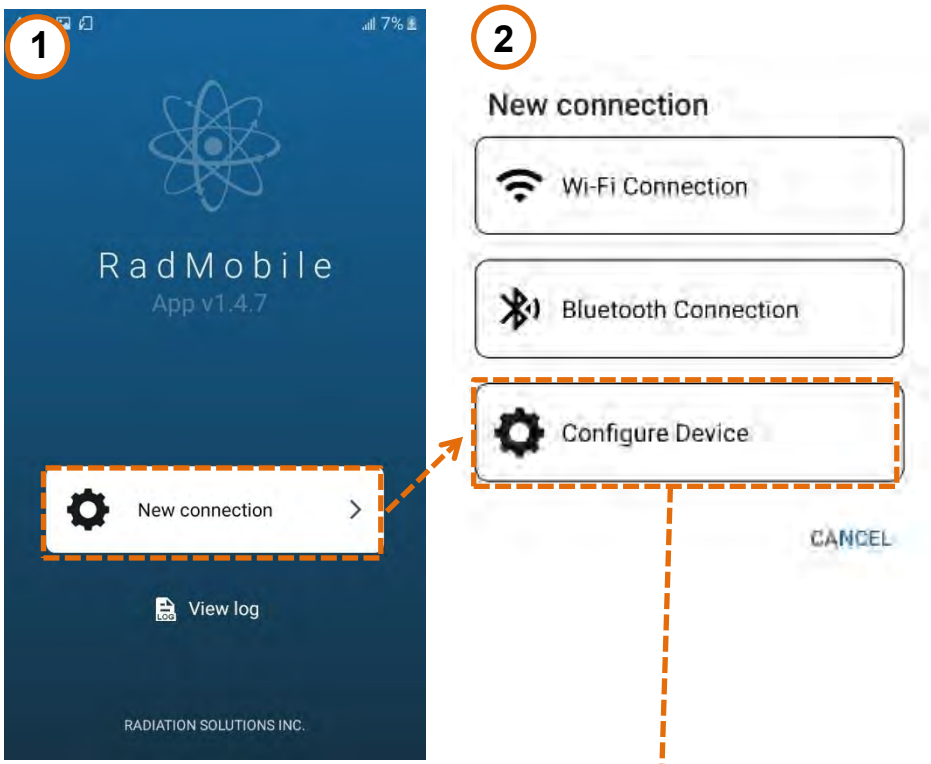




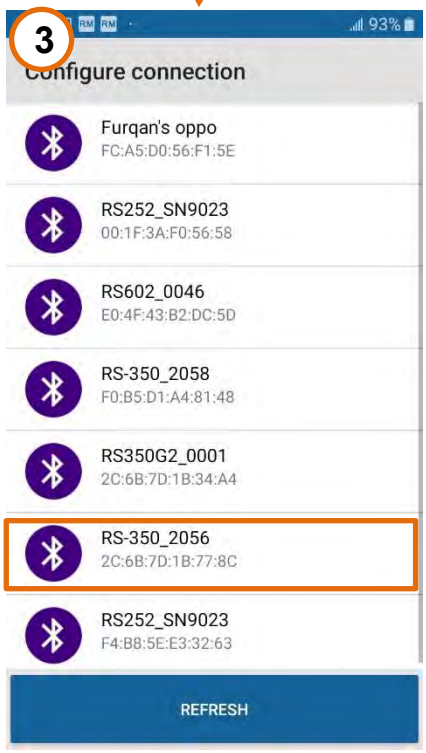
Backpack – Wi-Fi Hotspot – Android (First Connection)

Android:

1. Touch the **New Connection** button as shown to the right.
2. Touch the **Configure Device** button as shown to the right.

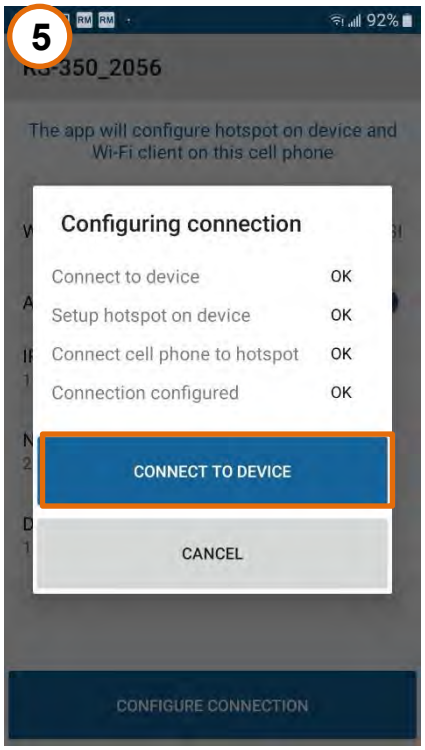


3. The **Configure Connect** page opens. Select the required device based on serial number.



4. Select "**Configure device as hotspot**".

5. The **Configure Connection** process begins. Wait until the process has listed **OK** for all fields. Once all OK, touch the **Connect To Device** button.

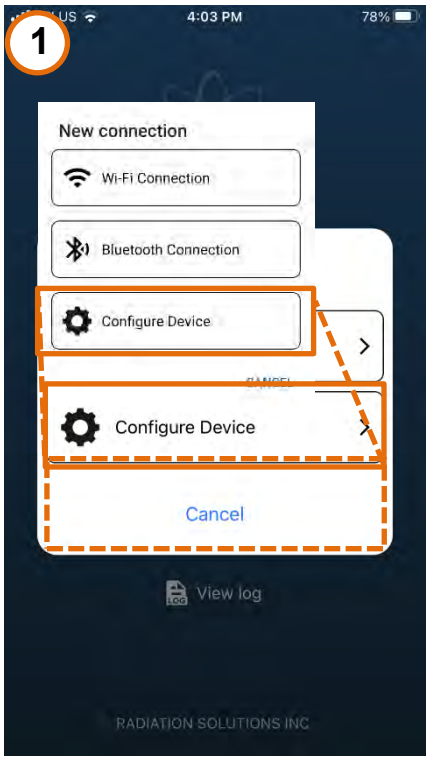


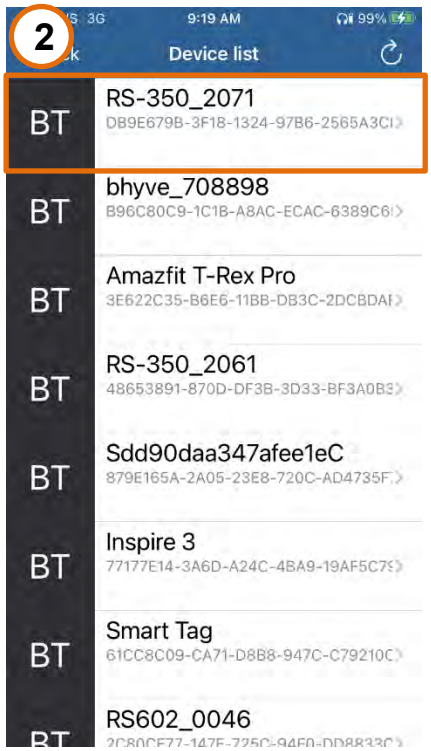
B. RSI Backpack – Wi-Fi Hotspot (First Connection)

iOS:

1. The **RadMobile Application** opens. Select **New Connection** and then select **Configure Device** as shown to the right.

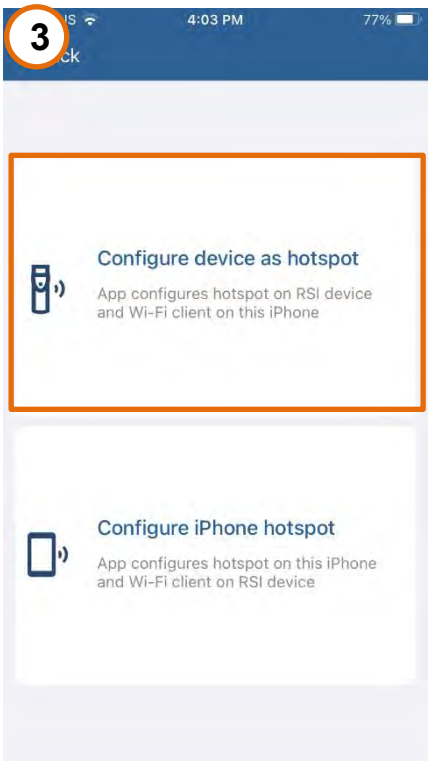
2. The **RadMobile Device List** opens with a list of all available devices. Select the required system based on serial number.

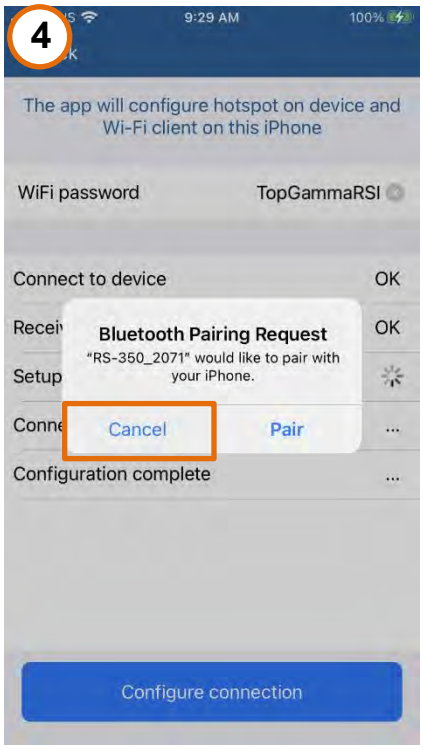




3. A new screen opens with two options for selection. Select "**Configure device as hotspot**".

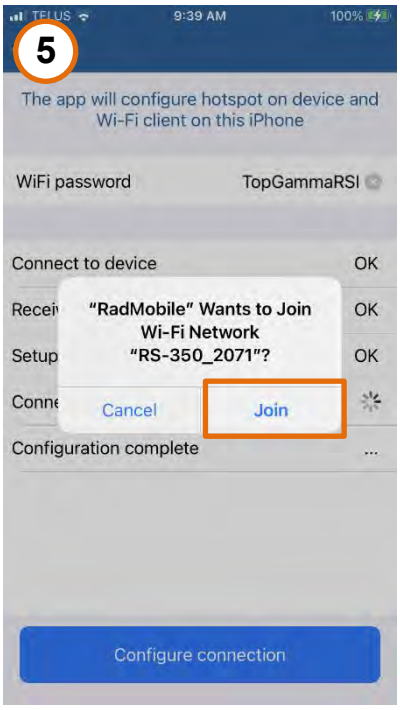
4. The **Configure Connection** process begins. A **Bluetooth Pairing Request** appears, select **Cancel.**

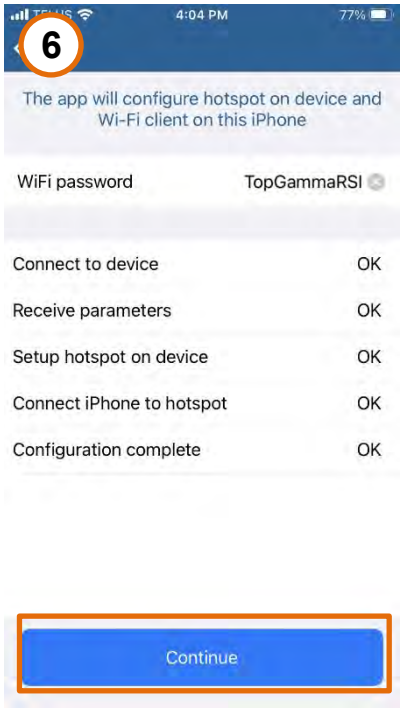




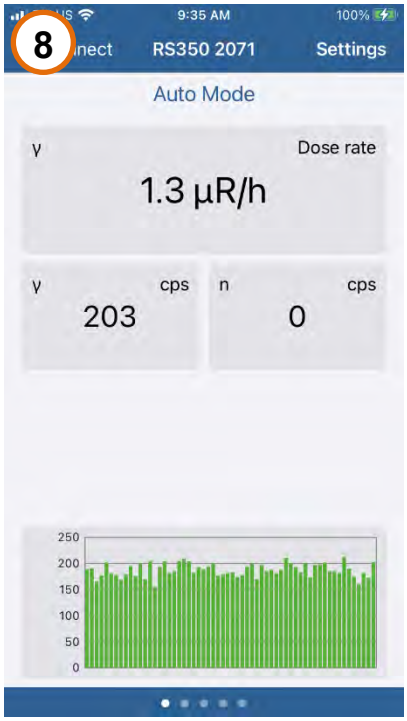
NOTE: Ensure that you **DO NOT** select the Pair button. Otherwise, subsequent connections may require users to unpair the backpack.

5. A **Wi-Fi Pairing Request** appears, select **Join.**
6. Wait until the process has listed **OK** for all fields. Once all OK, touch the **Continue** button.

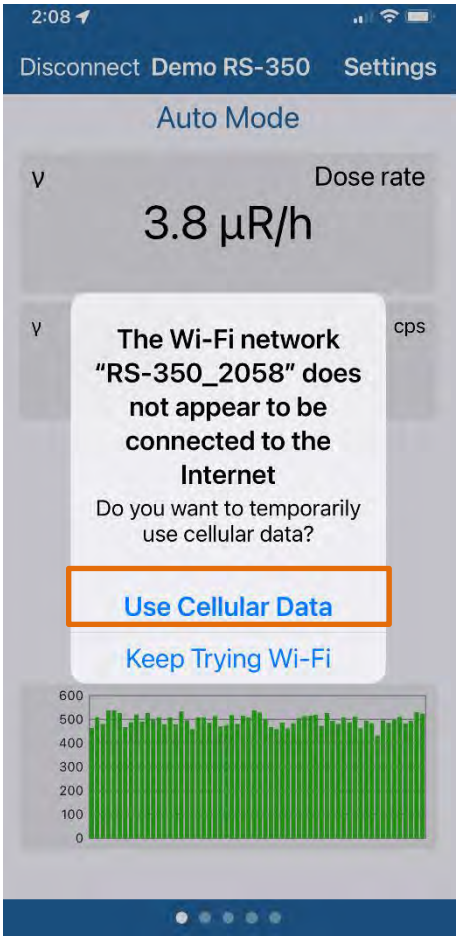




7. The **Device List** opens. Tap the system device name, as shown to the right, to connect.
8. The **RadMobile Application** connects to the required device and launches in **Auto Mode** as shown to the right.



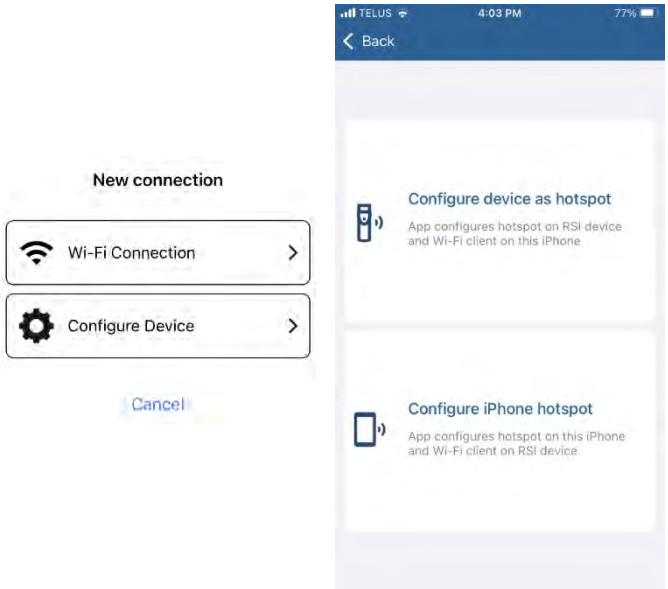
NOTE: If the system's Wi-Fi network goes down unexpectedly, iOS users have the option of temporarily switching over to cellular data to maintain a constant connection with the system device. Refer to the Figure to the right.



4.2.3 Setting Up the Phone as a Hotspot

A. Android

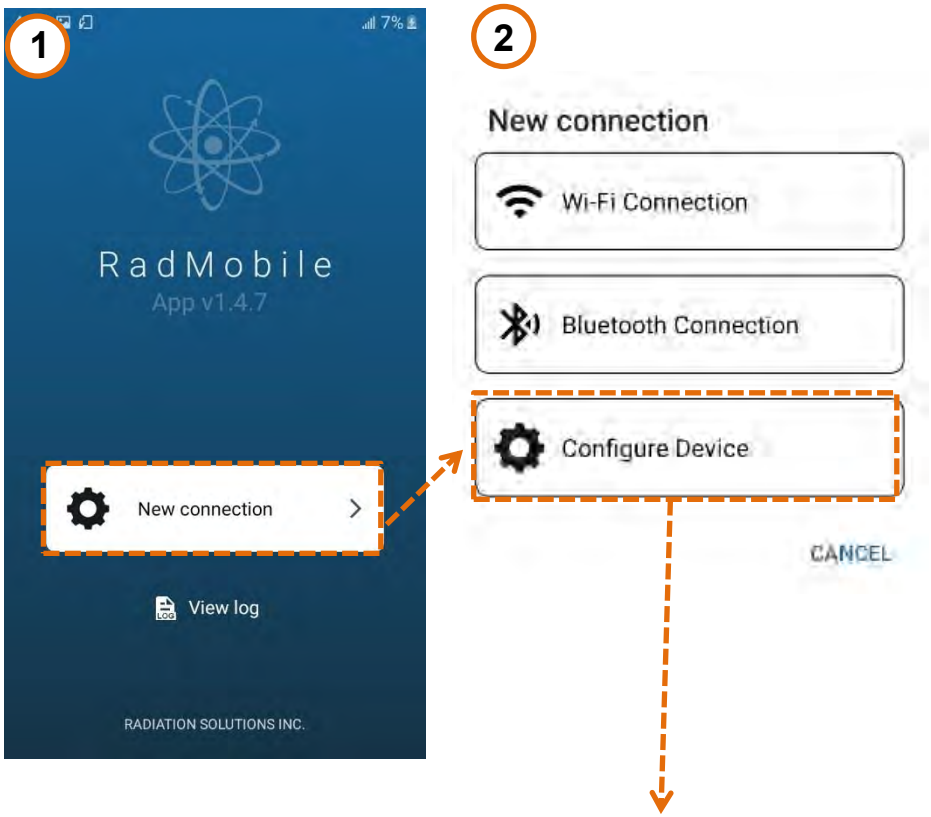
B. iOS



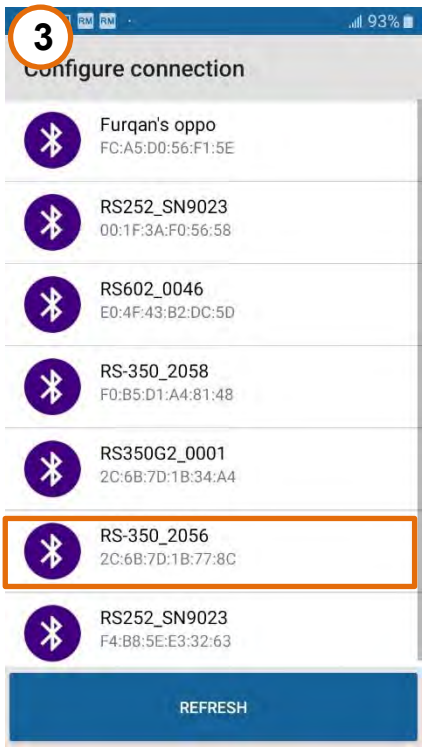
A. Setting up the Phone as a Hotspot

Android:

1. The **RadMobile Application** opens. Touch the **New Connection** button as shown to the right.
2. A pop-up window opens with three options for selection. Touch the **Configure Device** button as shown to the right.

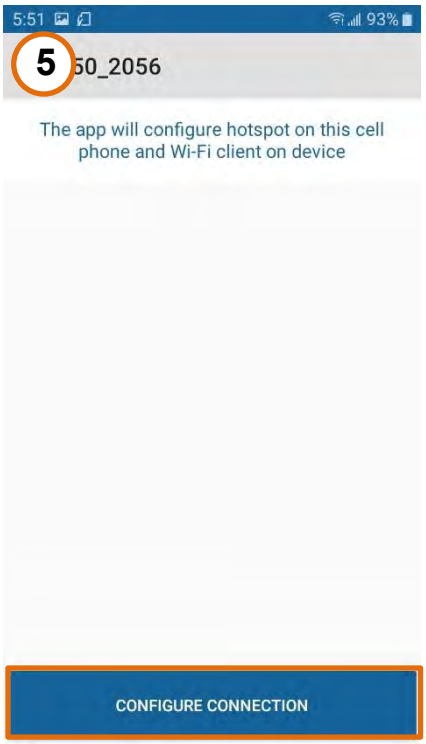


3. The **Configure Connect** page opens with a list of all available devices for connection in the area. Select the required system from the list *(e.g. RS-350_2056)*.

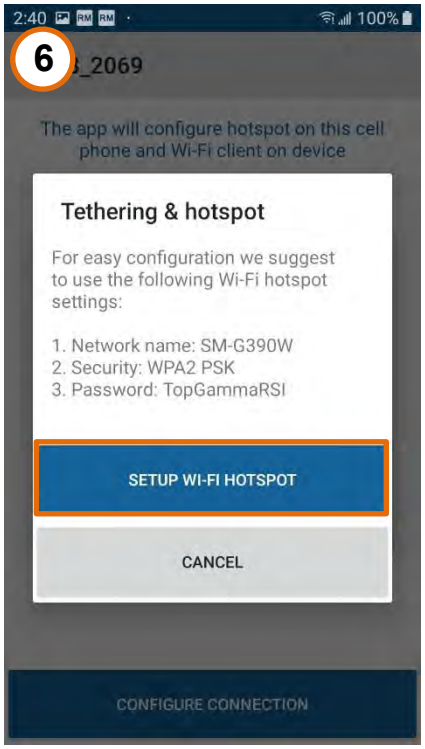


4. A new screen opens with four options for selection. Select "**Configure phone hotspot**" as shown to the right.

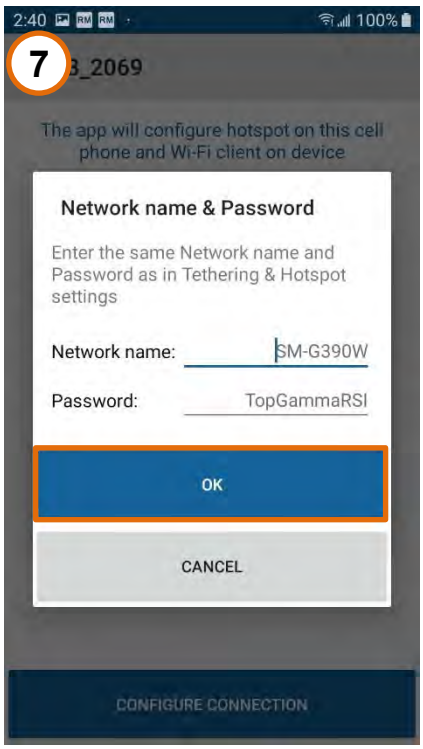
5. Select "**Configure Connection**" from the next screen as shown to the right.



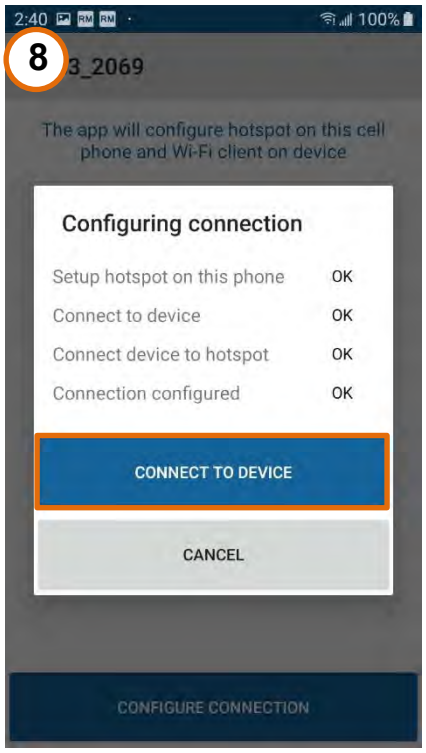
6. The **Tethering & Hotspot** pop-up window appears. Select "**SETUP WI-FI HOTSPOT**" as shown.



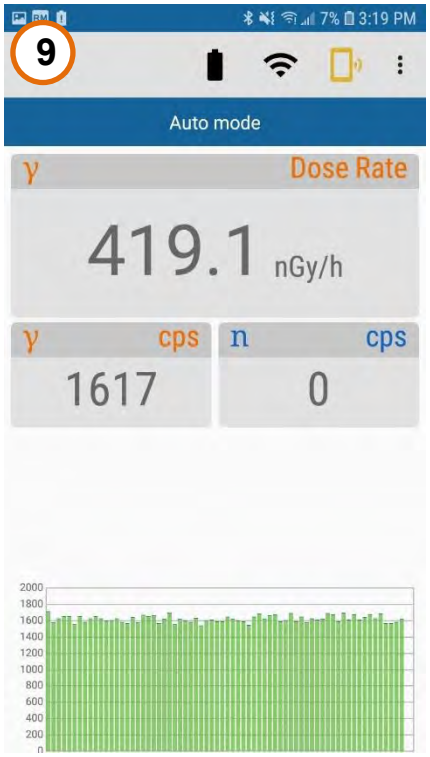
7. The **Network Name and Password** pop-up window appears. Select "**OK**" as shown.



8. The **Configure Connection** process begins. Wait until the process has listed **OK** for all fields. Once all OK, touch the **Connect To Device** button.



9. The **RadMobile Application** connects to the required device and launches in **Auto Mode** as shown to the right.

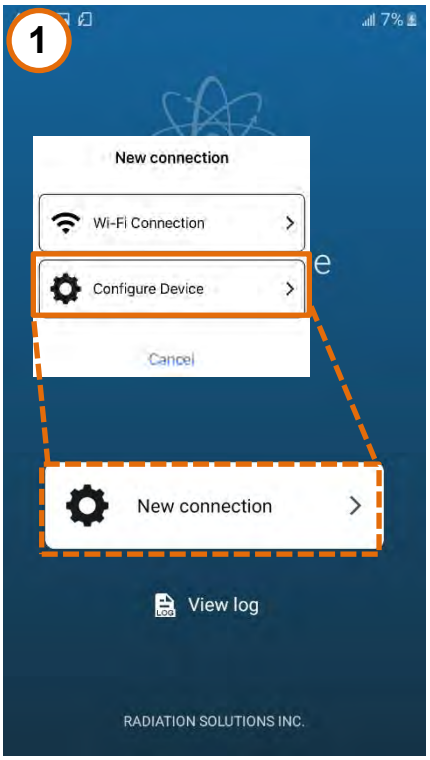


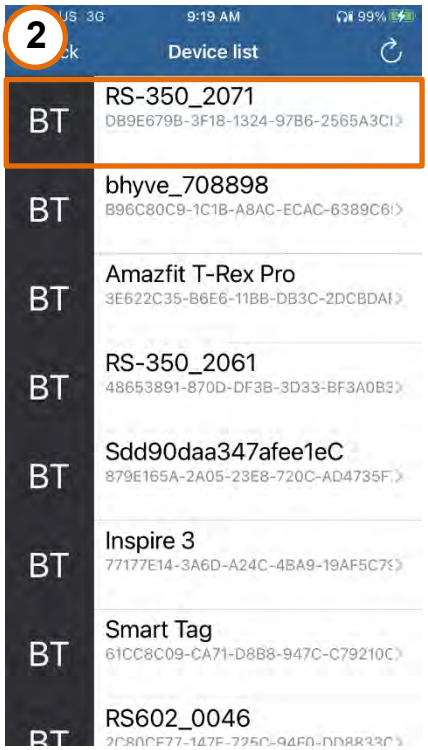
B. Setting up the Phone as a Hotspot

iOS:

1. The **RadMobile Application** opens. Select **New Connection** and then select **Configure Device** as shown to the right.

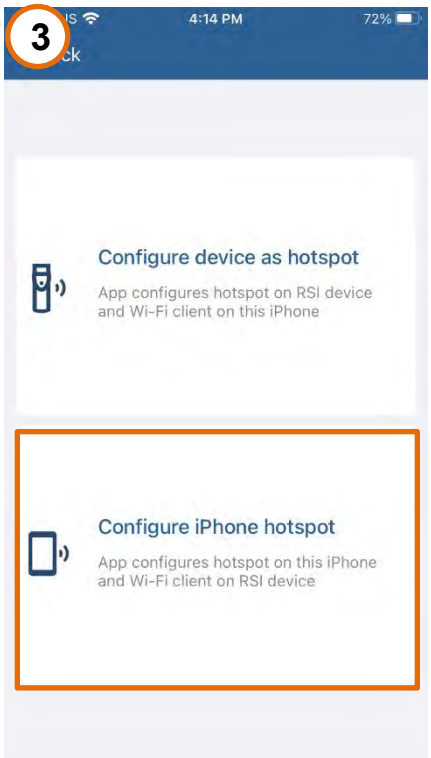
2. The **RadMobile Device List** opens with a list of all available devices for connection in the area. Select the required system from the list *(e.g. RS-350_2066)*.

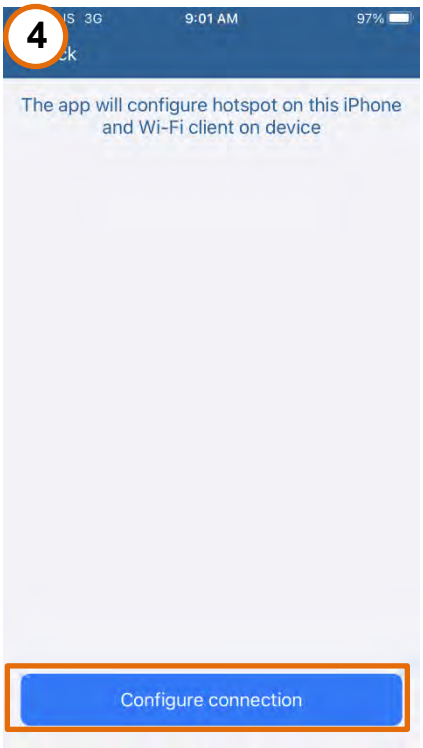




3. A new screen opens with two options for selection. Select "**Configure iPhone hotspot**".

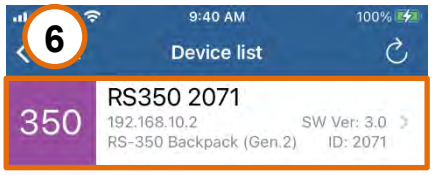
4. Select "**Configure Connection**" from the next screen.

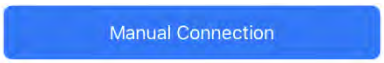




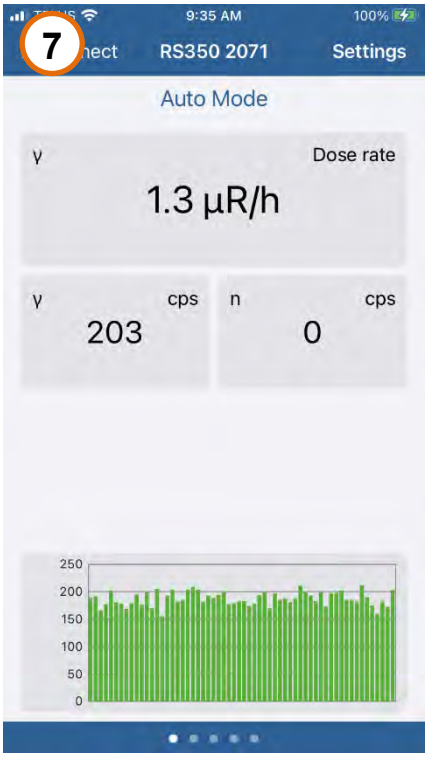
5. The **Configure Connection** process begins. Wait until the process has listed **OK** for all fields. Once all OK, touch the **Continue** button.

6. The **Device List** opens. Tap the system device name, as shown to the right, to connect.





7. The **RadMobile Application** connects to the required device and launches in **Auto Mode** as shown to the right.



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5.0 USING AUTO MODE

5.1 RadMobile Auto Mode Display Overview

DEVICE COMMUNICATION STATUS:

– NOT CONNECTED/ERROR – CONNECTING/STABILIZING – CONNECTED/STABILIZED

Page Toggle – switches the page to the **Device Status** page. This icon also indicates the device's connection status, **GREEN** – Connected, **RED** – Error *(i.e., Connection error, GPS error, etc.)*, **YELLOW** – Connecting Device.

SYSTEM BATTERY STATUS:

– STATUS UNKNOWN – FULL CHARGE – LESS CHARGE

– Page Toggle to Auto Mode Page

5.1.1 Vertical Display Mode

The following screen opens: **Live Screen – Auto Mode**

The application will commence measuring the system and monitoring for radioactive elements.

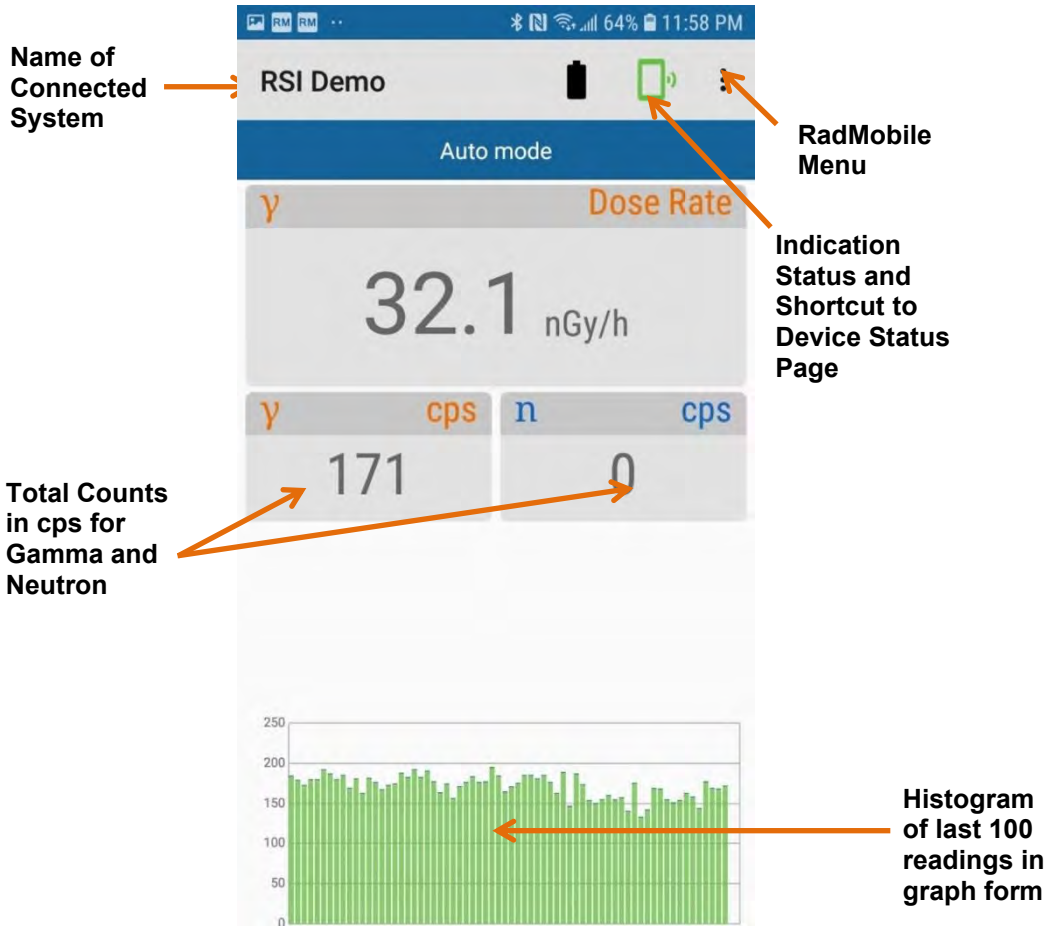


Figure A: Android Display Overview

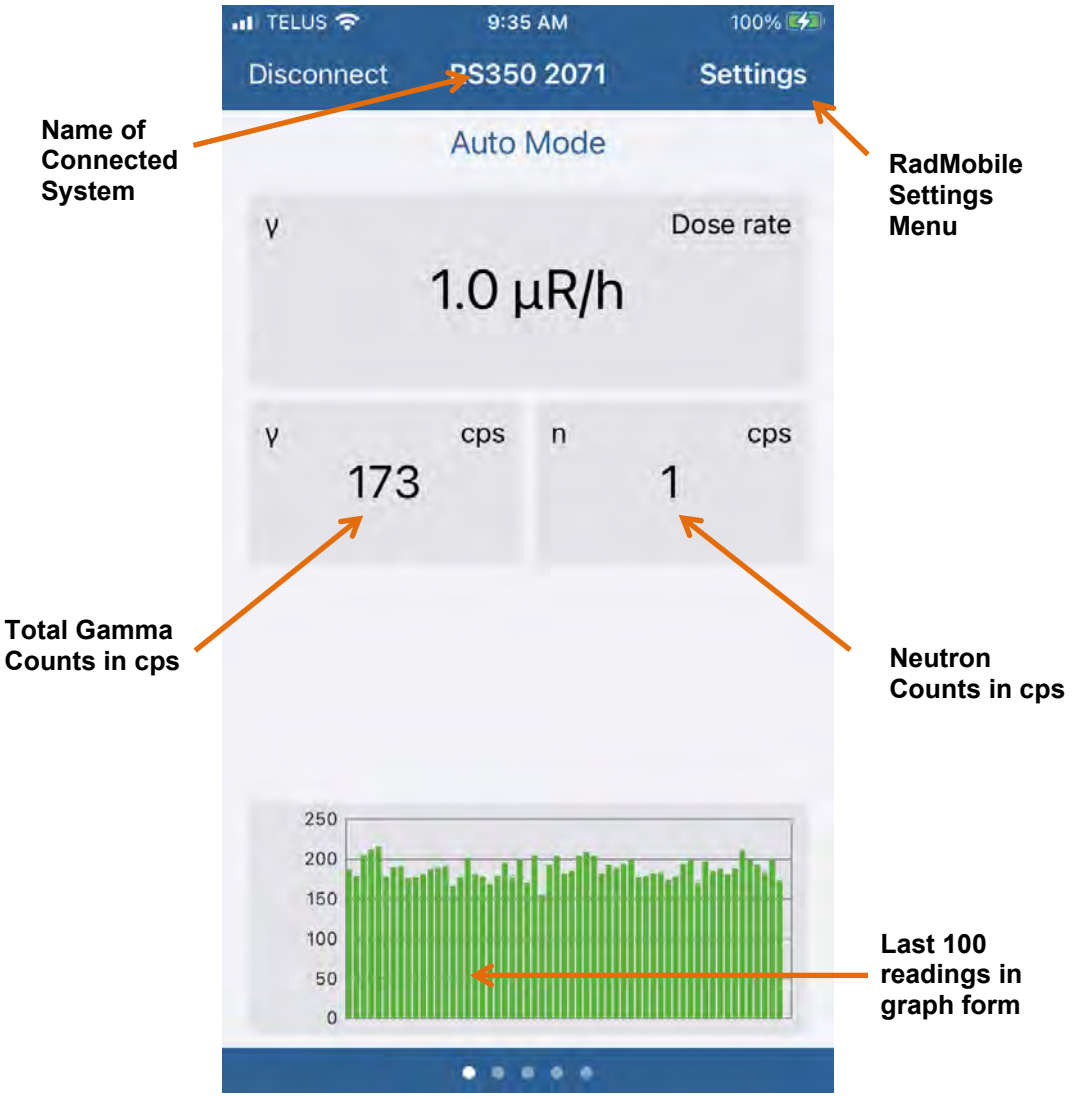
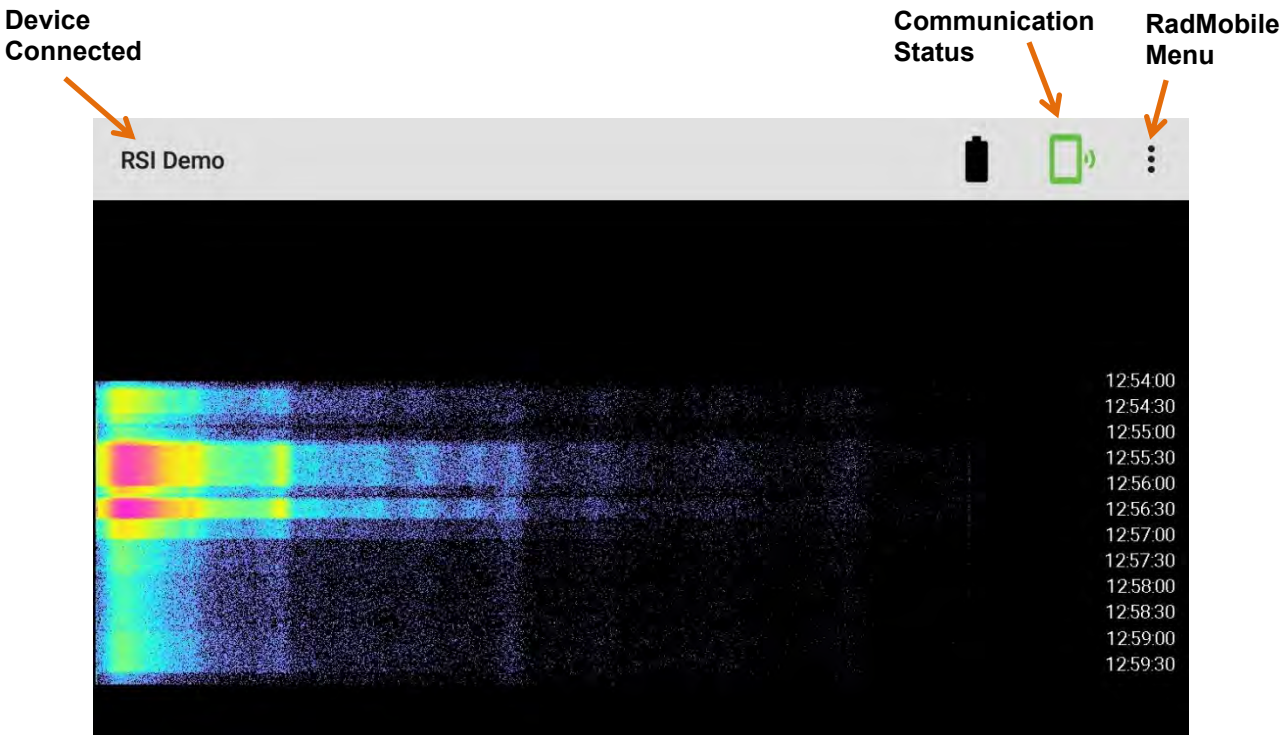


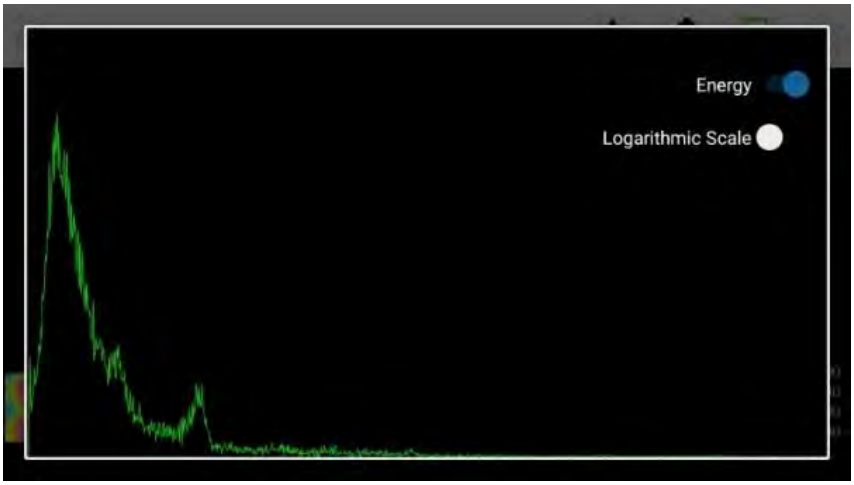
Figure B: iOS Display Overview

5.1.2 Horizontal Display Mode

While in **Auto Mode**, if a user turns their mobile phone sideways, **Horizontal View Mode** activates *(as shown below)* and displays a stacked spectral waterfall that updates at a rate of one sample per second *(0keV on the left and 3000keV on the right boundary)*.



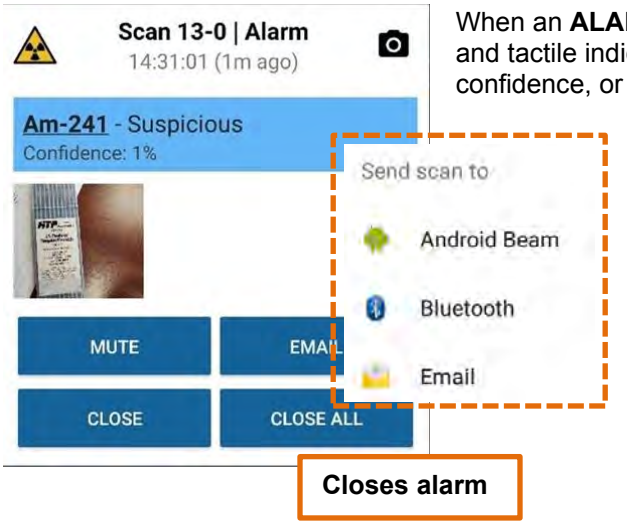
The user may select a portion of the **WATERFALL DISPLAY**.



Once a desired selection has been made, the **Summed Spectral Graph** window opens.

NOTE: Android version displayed here. iOS auto mode looks and functions the same. Only difference is in horizontal mode, iOS has no menu or option to disconnect.

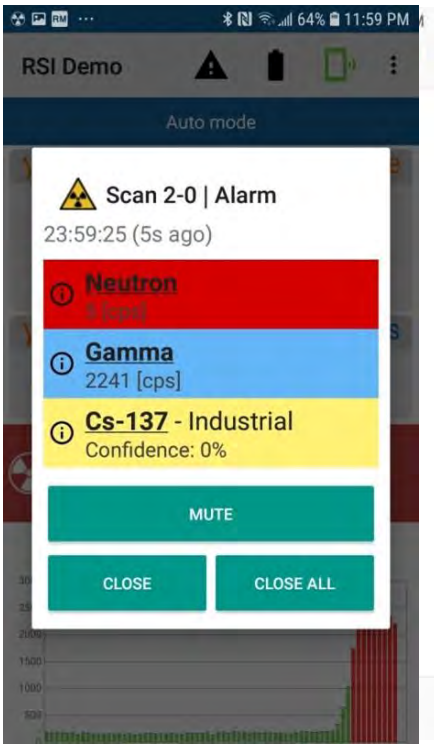
5.1.3 Alarms



When an **ALARM** occurs, an alarm dialog displays with an audible and tactile indication. The alarm displays isotopes and classification, confidence, or counts.

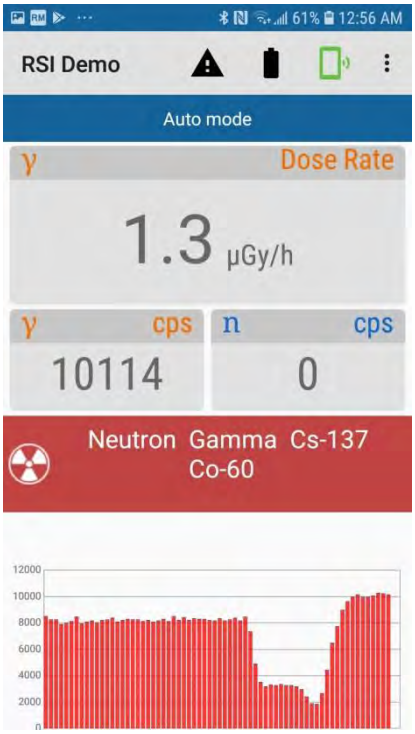
You can mute, add a picture, or look at isotope information. Close will close only the latest or top dialog. Close all will close all alarms. Touch **EMAIL** to prepare all N42 files and pictures into an email addressed to your default address ready to send.

NOTE: Android version displayed here. iOS alarms look and function the same.



Isotope Information – further info can be found by clicking this link (as shown in the Figures to the left).

If the alarm dialog is closed while the alarm is still occurring, an alarm banner shows the examples:


61% 12:56 AM
RSI Demo
Auto mode
γ
Dose Rate
1.3 μGy/h
γ cps
10114
n cps
0
Neutron Gamma Cs-137
Co-60
12000
10000
8000
6000
4000
2000
0

5.2 RadMobile Application Settings

Touch the **RadMobile Menu** button and select **App Settings** as shown from the drop-down menu.

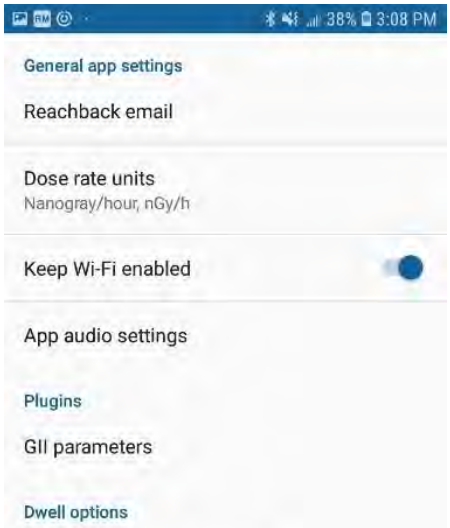
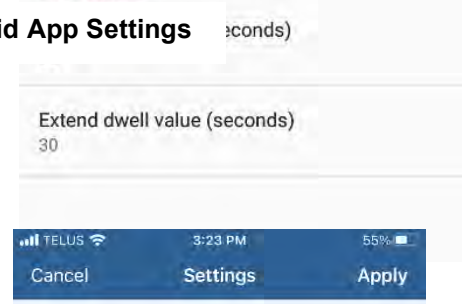
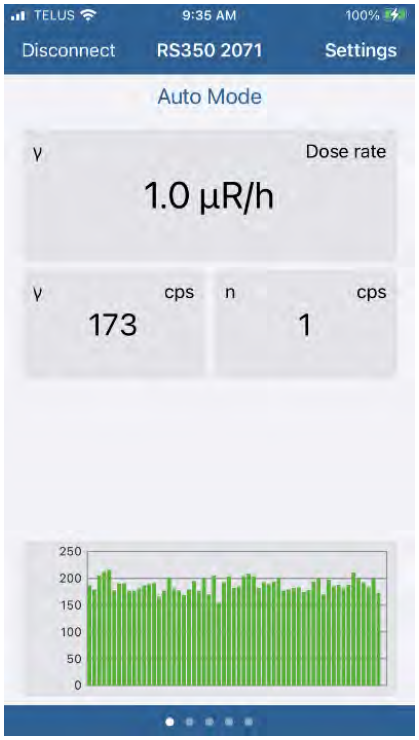
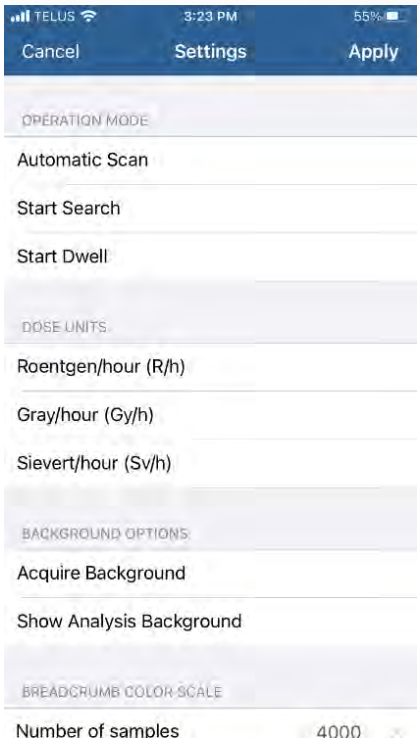


Figure A: Android App Settings



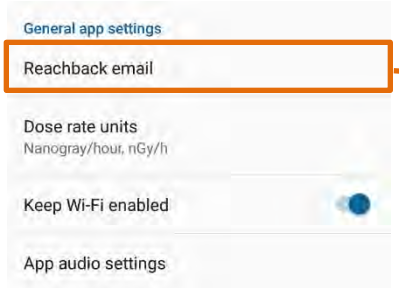


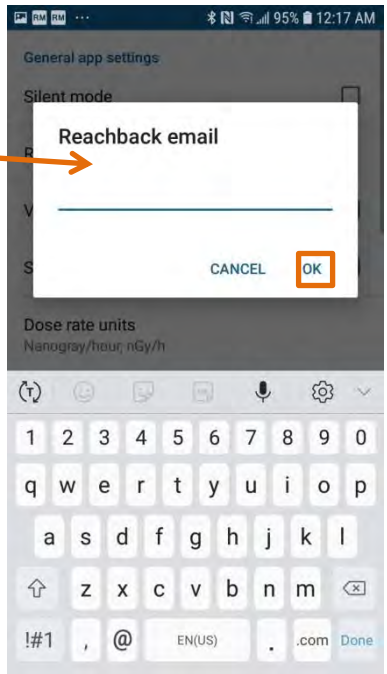


5.2.1 Reachback Email

You can enter an address that pre-populates outgoing reachback emails. Reachback emails can be used to send pre-packaged N42 alarm data.

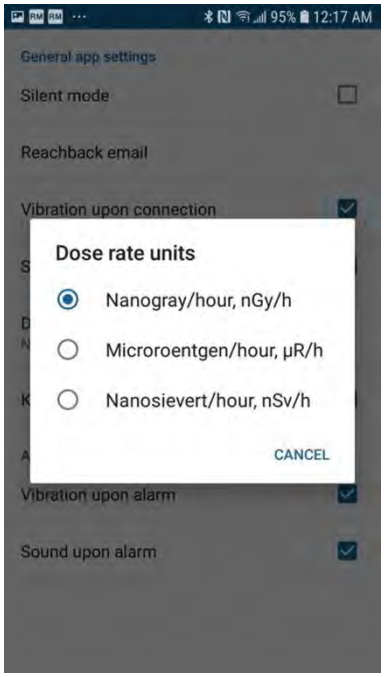
The operator can send the current a **Reachback email** under **General App Settings**.



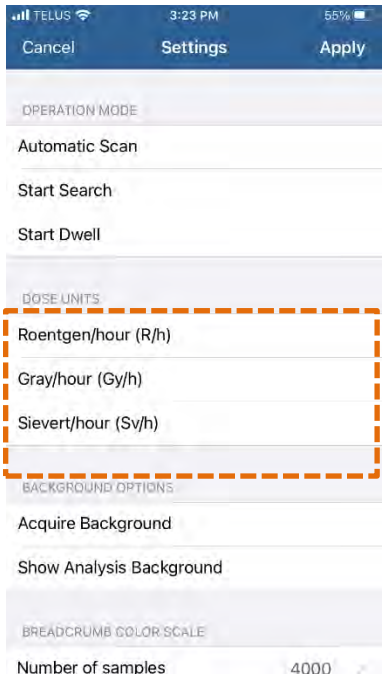


5.2.2 Dose Units

Permits the user to change the units of dose to be displayed in **Auto Mode**. Three radio buttons are available for selection: **Nanogray/hour** *(nGy/h)*, **Microroentgen/hour** *(µR/h)*, and **Nanosievert/hour** *(nSv/h)*. Refer to the Figure on the right.



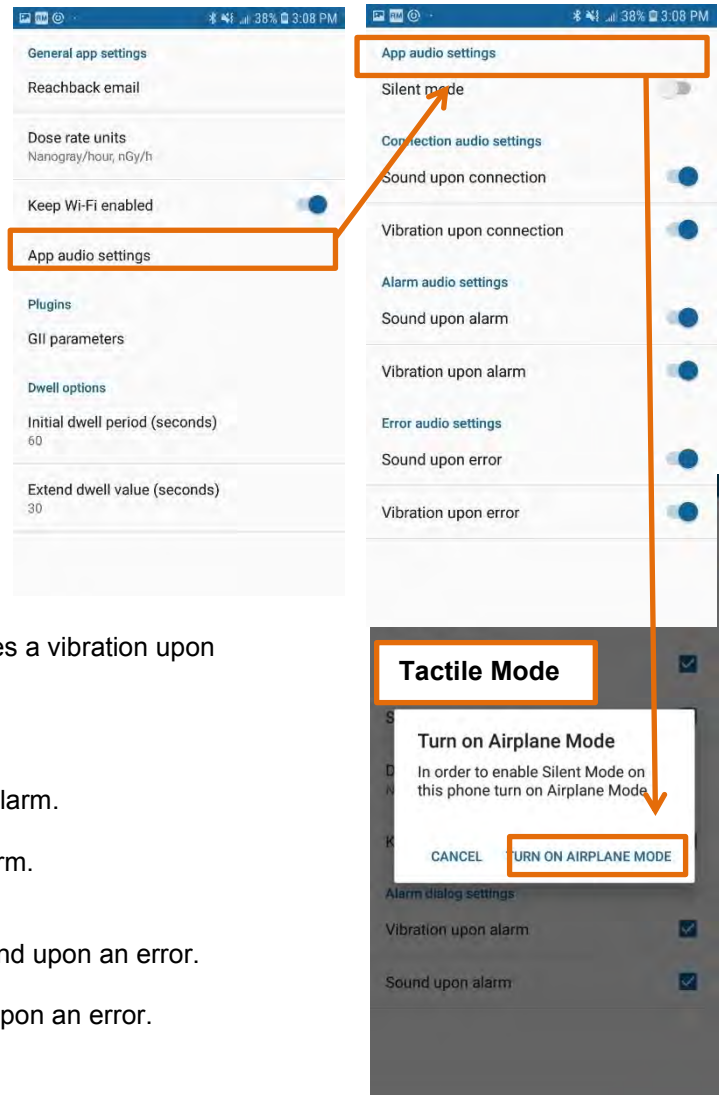
Android



iOS

5.2.3 App Audio Settings

The **App Audio Settings** screen is opened from the **General App Settings**.



App Audio Settings

Silent Mode – when enabled, this option silences all sounds produced by the **RadMobile App**.

Sound Upon Connection – produces an audible sound upon RadMobile connection or reconnection.

Vibration Upon Connection –the app produces a vibration upon RadMobile connection or reconnection.

Sound Upon Alarm –audible sound upon an alarm.

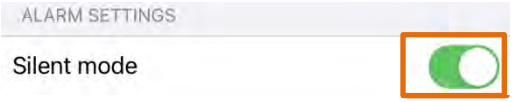
Vibration Upon Alarm – vibration upon an alarm.

Sound Upon Error – produces an audible sound upon an error.

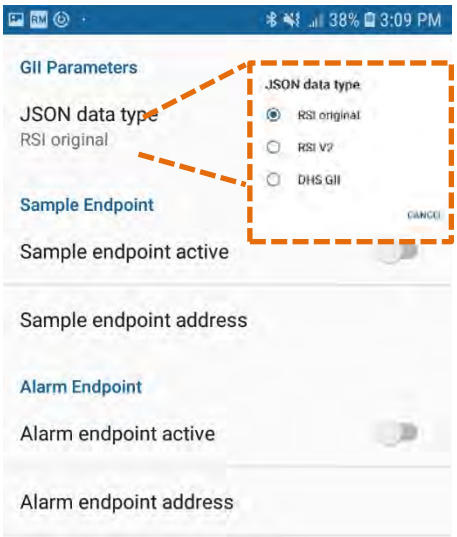
Vibration Upon Error – produces a vibration upon an error.

iOS Alarm Settings

Silent Mode – when enabled, this option silences all sounds produced by the **RadMobile App**.



5.2.4 Plugins – GII Parameters



The **Plugins** screen is opened from the General App Settings screen and is split into three sections: **GII Parameters**, **Sample Endpoint** (connection server), and **Alarm Endpoint** (connection server).

JSON Data Type – selection of three remote server types for data to be stored: RSI v2, RSI Original, or DHS GII *(Default = RSIv2)*.

Sample Endpoint Active – enables or disables the sample endpoint.

Sample Endpoint Address – address of the sample being sent server endpoint.

Alarm Endpoint Active – enables or disables the alarm endpoint.

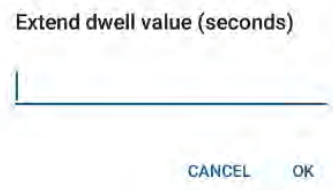
Alarm Endpoint Adress – address of the alarm being sent server endpoint.

NOTE: Android version displayed, iOS Plugins function and look the same.

5.2.5 Dwell Options

Dwell is a timed collection.

Initial Dwell Value (seconds) – allows the user to change the amount of time the system collects for.

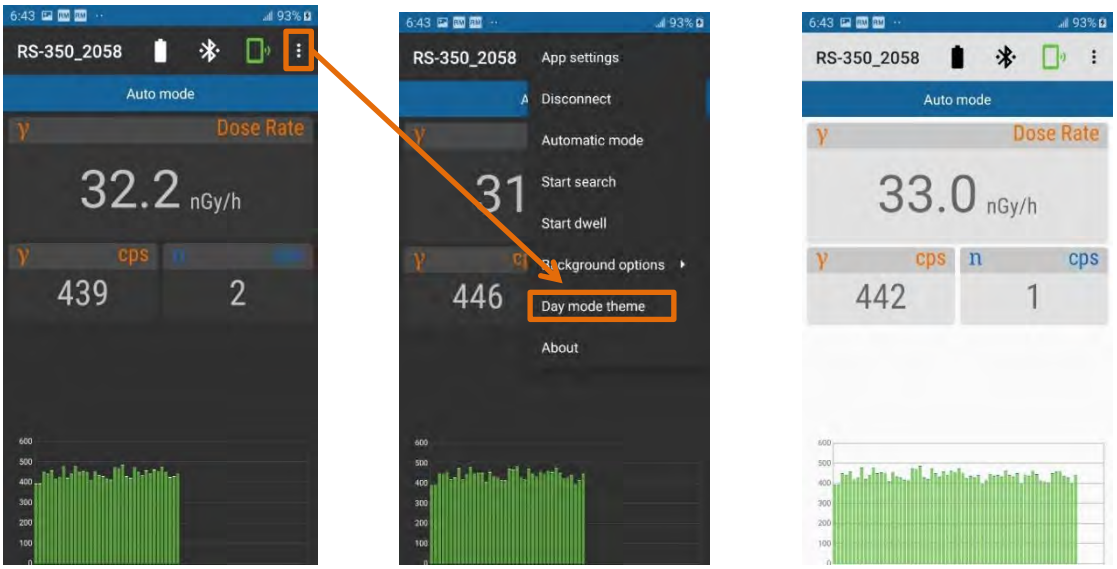


Extend Dwell Value (seconds) – allows the user to match this time to your SOPs.

NOTE: Android version displayed, iOS Dwell Options function and look the same.

5.2.6 Day and Night Mode Themes – Android Only

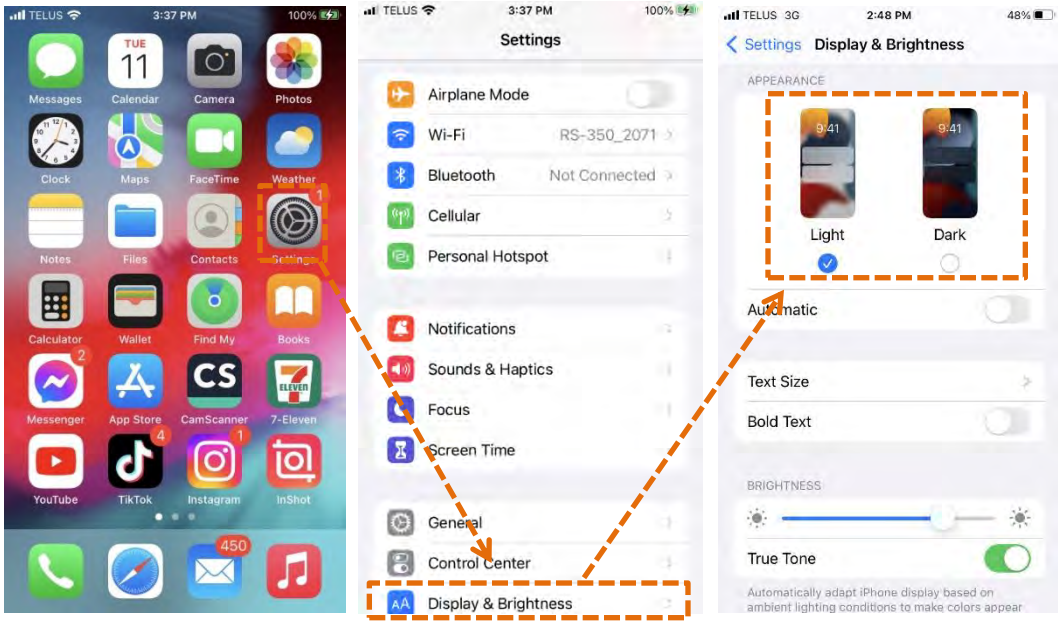
RadMobile has incorporated **Day** and **Night Mode themes** which are accessible from the application's main menu as shown below.



5.2.7 Dark and Light Mode iOS

To enable Dark and Light mode use within the RadMobile app, the user must:

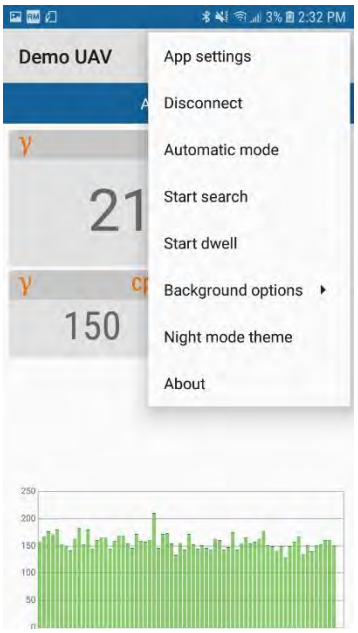
1. Tap the Settings icon.
2. Select Display & Brightness from the Settings menu.
3. Select either Light or Dark mode from the Display & Brightness menu.

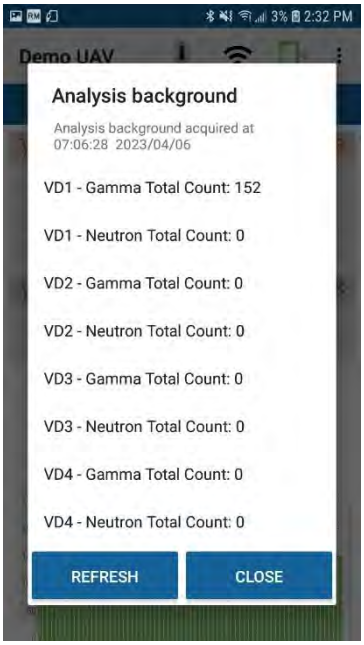


5.2.8 Background Options

The operator can use the **Background Options** to display the current background and allows users to force a new background collection. Background is used to establish some alarm thresholds. These thresholds can be viewed by selecting "**Analysis Background**" as shown below. Background is automatically collected at regular intervals on a non-interference basis, if no alarm is occurring.

ANDROID:

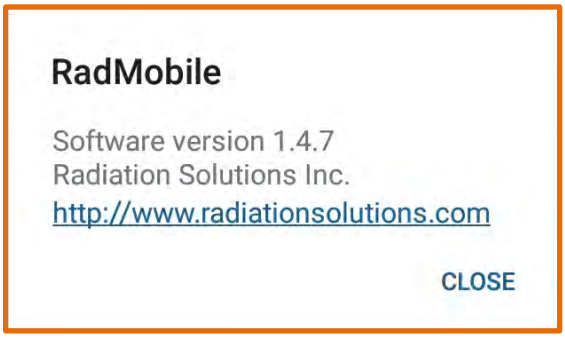




5.2.9 About

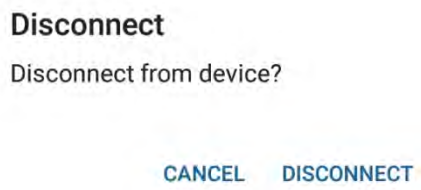
This window contains the applications software version and a link to the RSI website. Press the **CLOSE** button to close this window.

NOTE: The iOS version does not contain an **About** section.



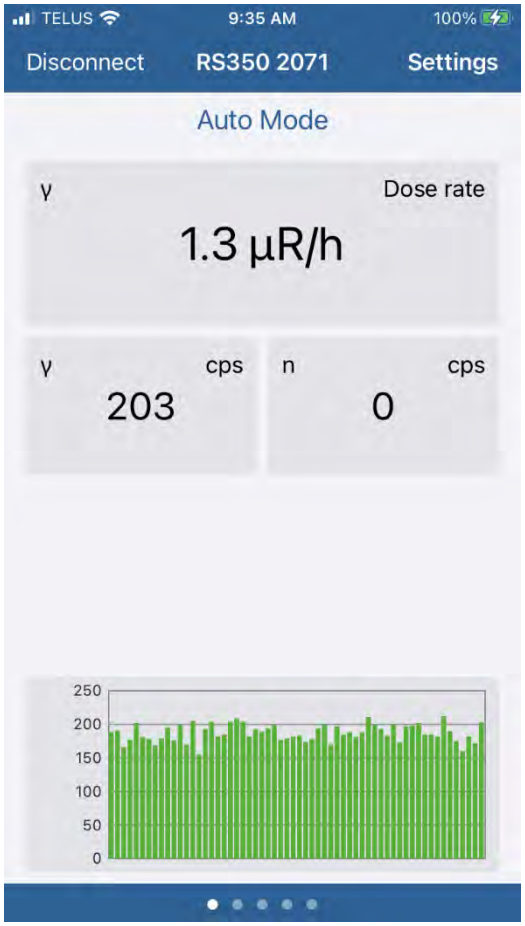
5.2.10 Disconnect

ANDROID:



To disconnect from the device, the user selects "**DISCONNECT**" from the **RadMobile App** drop-down menu and then taps "**DISCONNECT**" as shown to the left.

iOS:



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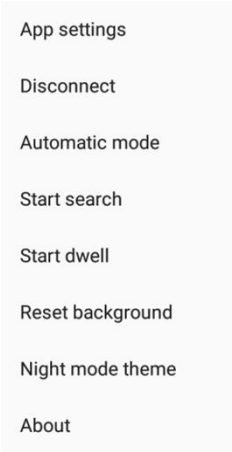
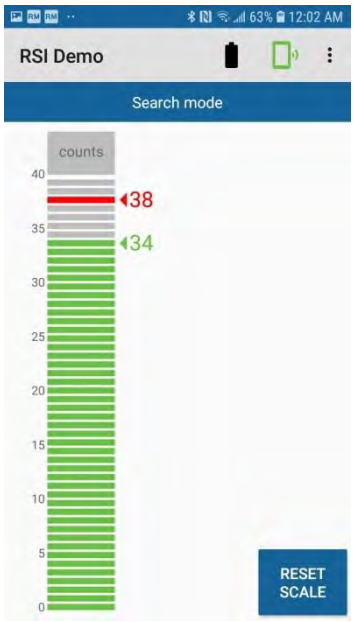
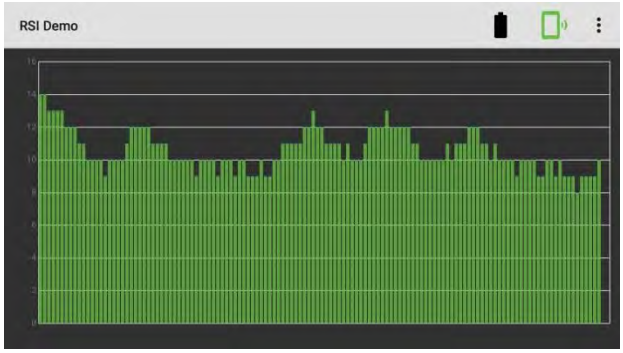
6.0 USING SEARCH MODE

6.1 Search Mode





START SEARCH: Search Mode runs at 10 times per second with a bar graph displaying the current gamma counts per tenth (shown to the right). The maximum value is launched for reference.



When your external data acquisition device is rotated into a horizontal position, **Horizontal View Mode** enables and displays a bar graph accumulating from left to right *(shown to the left)* at a rate of ten samples per second.

NOTE: Android version displayed here. iOS search mode looks and functions the same. Only difference is in horizontal mode, iOS has no menu or option to disconnect.

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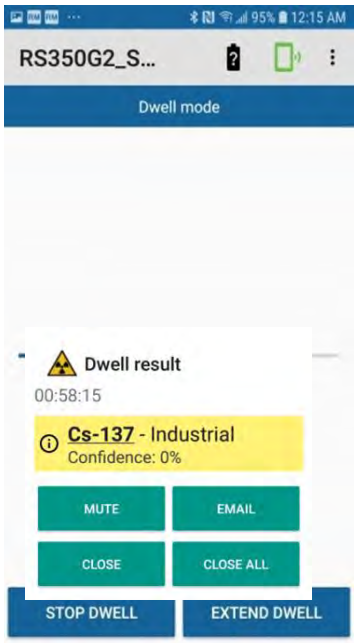
7.0 USING DWELL MODE

7.1 Dwell Mode



START DWELL: This initiates a dwell or timed accumulation. The dwell mode screen displays a countdown of time and buttons to EXTEND or STOP the collection. At the end of the collection an analysis is done. The results will show in a window regardless of whether an isotope is identified or not.

NOTE: Android version displayed here. iOS dwell mode looks and functions the same.

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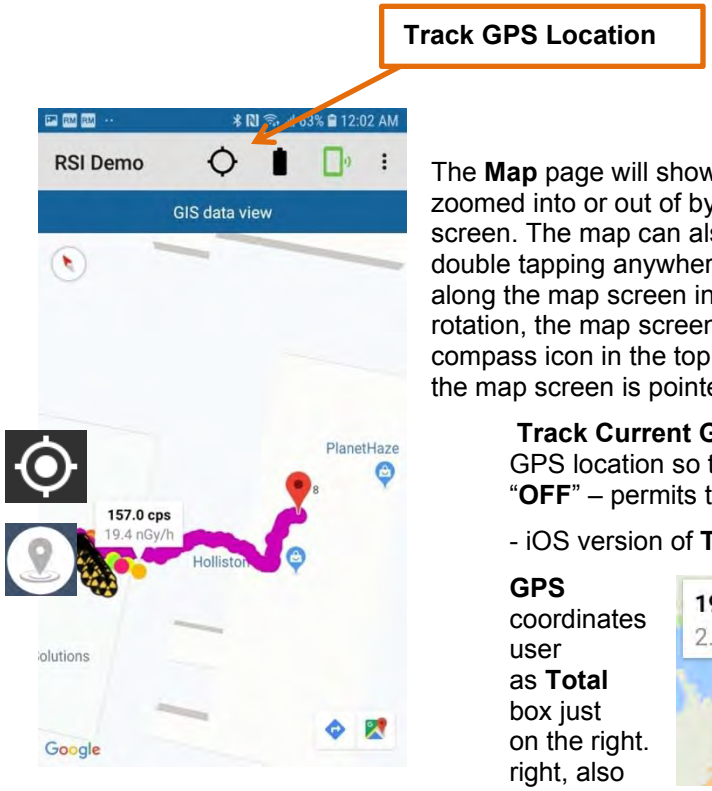
8.0 USING THE MAP PAGE

8.1 Map Page

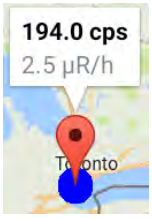


The **Map** page will show the GPS location of the device and can be zoomed into or out of by using two fingers to pinch or spread the screen. The map can also be zoomed into by one level increments by double tapping anywhere inside the map screen. If you twist two fingers along the map screen in either a clockwise or counterclockwise rotation, the map screen will rotate in that direction and will display a compass icon in the top left corner of the screen indicating the direction the map screen is pointed towards.

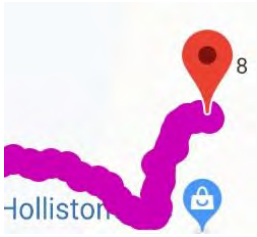
Track Current GPS Location – toggle "**ON**" moves the current GPS location so that it appears on the displayed map screen. "**OFF**" – permits the user to pan anywhere on the screen.

- iOS version of **Track Current GPS Location**.

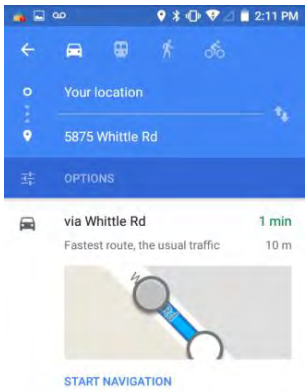
GPS coordinates user as **Total** box just on the right. right, also the map



Location – displays the world for the connected RSI system. If a touches this icon, information such **Counts** is displayed in a small data above the icon. Refer to the Figure Two new buttons, as shown to the appear in the bottom right corner of screen when this icon is touched.



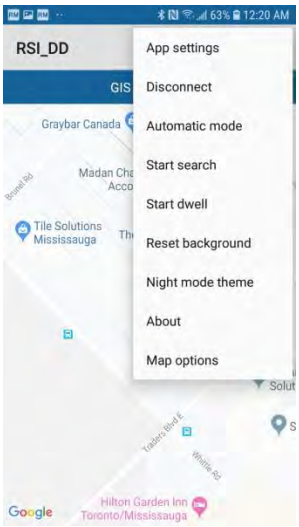
These two new buttons provide the user with the ability to open the current map screen within a mobile app version of **Google Maps** in order to obtain directions or more detailed positional information related to your current area of detection. See the Figure to the right.

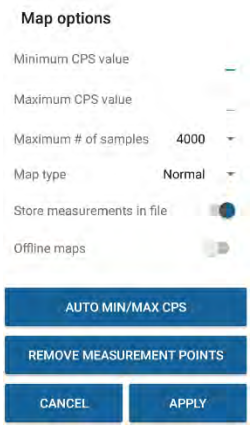


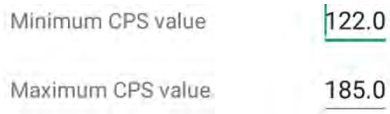
The value range is: **Purple < 300.0** – Blue – Light Blue – Green – Amber – **Red > 2700.0**; Radiation data intensity changes in the survey and is displayed as a "**BREADCRUMB PLOT**" which plots radiation intensity as a function of location. Colour is used to show the intensity of this radiation. The colour ranges from purple to red, and the data is selected automatically based on the data range detected.

NOTE: Android version displayed here. iOS Map page looks and functions the same.

Android Map Options:

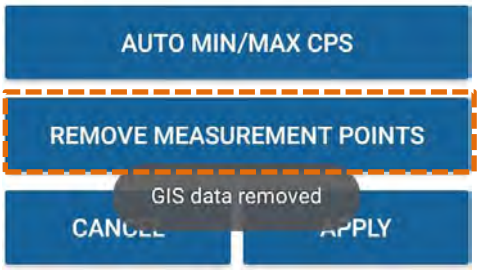




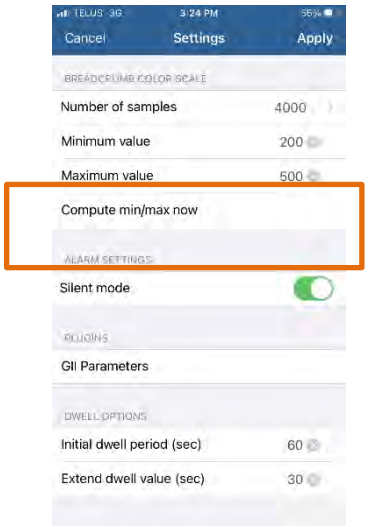


To adjust the **Colour Scale**, select "**AUTO MIN/MAX CPS**" and then "**APPLY**" *(enters the minimum and maximum CPS*

To erase previous data, click the Remove Measurement Points button as shown to the right.

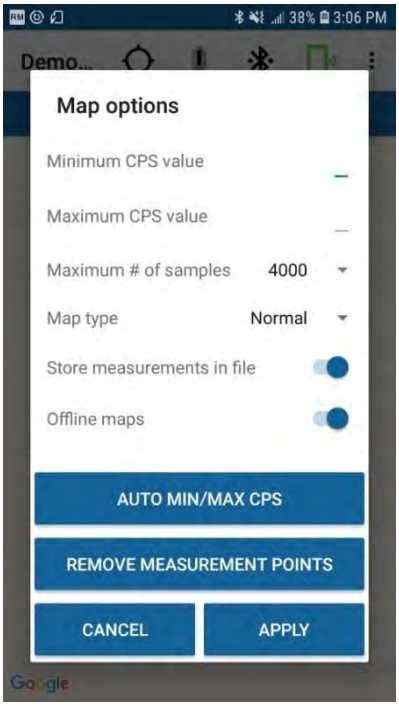


iOS Breadcrumb Color Scale:



To adjust the **Colour Scale**, select "**Compute MIN/MAX now**" and then "**APPLY**" *(enters the minimum and maximum CPS*

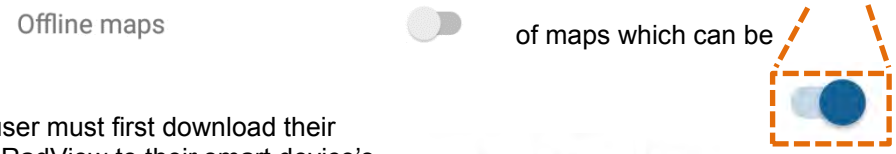
ANDROID MAP OPTIONS CONT'D:



Map Type – select between two different types of maps: **Satellite** or **Normal** *(default = Normal)*.

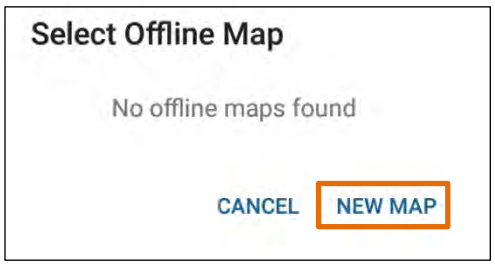
Store Measurements in File – permits the phone to store breadcrumb measurements that will remain if the app is closed and reopened.

Offline Maps – database / folder of maps which can be used when offline.



If a user requires offline maps, the user must first download their necessary maps from MapAssist or RadView to their smart device's download folder.

To enable offline maps select **Offline Map** *(as shown)*. To add a map, touch **NEW MAP**. This opens the **Download** folder of your smart device. Select the map file from the Download folder and touch **OPEN**.



The selected offline map should now be listed within the **Select Offline Map** pop-up. Select the required offline map from the list and touch **OK.** The selected offline map now appears within the Map page for offline use.

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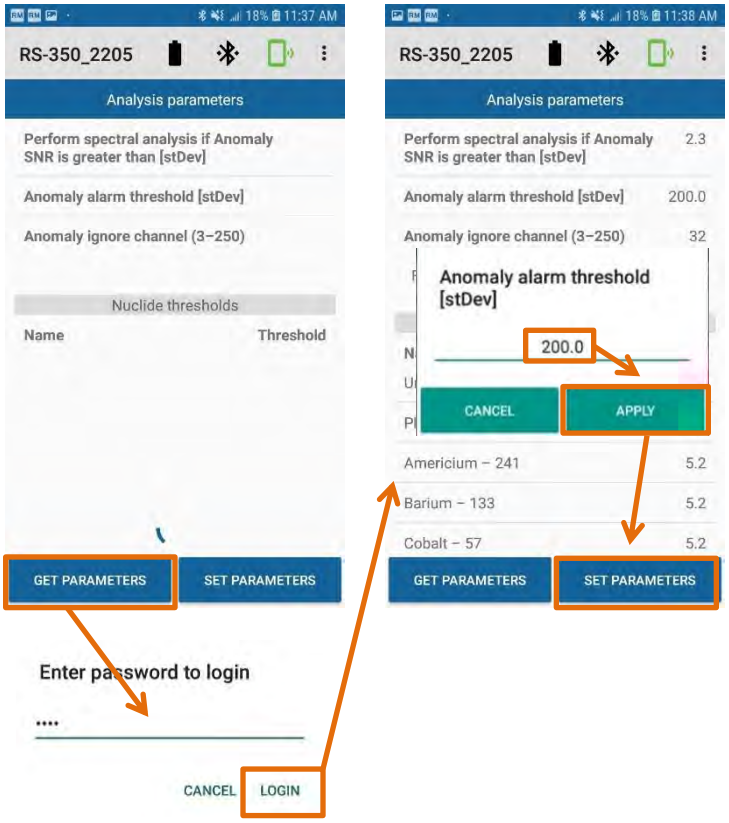
9.0 USING DEVICE PARAMETERS PAGE

9.1 Device Parameters Page

The operator should first touch the **GET PARAMETERS** button to enter the current parameters from the system. A Password is required to continue (the serial number of the device is the default password).

To make a change to individual parameters, the operator selects a parameter by touching the screen. This opens a data window where the parameter can be changed to suit the user's needs.

Touch the **APPLY** button to accept or the **CANCEL** button to reject the change. Touch the **SET PARAMETERS** button to save the changes into memory.



DEVICE PARAMETERS:

Perform spectral analysis if Anomaly SNR is greater than [stDev] – **2.75**

Anomaly Alarm threshold [stDev] – **200.0**

Anomaly ignore channel (3-250) – **32**

Filter 1 Length [samples]: **1**

Filter 2 Length [samples]: **2**

Filter 3 Length [samples]: **4**

Filter 4 Length [samples]: **8**

NUCLIDE THRESHOLDS:

Name	Thr	ID	Name	Thr	ID	Name	Thr	ID
U-235	7.0	0x00EB5C00	Ra-226	22.0	0x00E25800	Ir-192	10.0	0x00C04D00
Pu-239	7.0	0x00EF5E00	Th-228	6.0	0x00E45A00	Cr-51	6.0	0x00331800
Am-241	5.0	0x00F15F00	Tc-99	8.0	0x00632B10	In-111	8.0	0x006F3100
Ba-133	6.0	0x00853800	Ga-67	15.0	0x00431F00	Sm-153	12.0	0x00993E00
Co-57	6.0	0x00391B00	I-131	15.0	0x00833500	Mo-99	6.0	0x00632A00
Co-60	6.0	0x003C1B00	Ti-201	8.0	0x00C95100	Ge-68	6.0	0x00442000
Cs-137	6.0	0x00893700	Th-232	33.0	0x00E85A00	Cosmic	300.0	0x03EB0000
Na-22	10.0	0x00160B00	K-40	33.0	0x00281300	Eu-152	14.0	0x00983F00
Np-237	12.0	0x00ED5D00	U-238	7.0	0x00EE5C00	F-18	6.0	0x00120900

NOTE: Android version displayed here. iOS Device Parameters page looks and functions the same.

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10.0 USING DEVICE STATUS PAGE

10.1 Device Status Page

The **Device Status Page** displays the current status information of the connected device.

The following information is displayed:

Communication – Displays **TCP connection status** if connected via **Wi-Fi**, or **Bluetooth status** if connected by **Bluetooth**.

Device Serial Number – e.g., 2006

Device Software version – e.g. 1.3.3

Device UTC – 2019-06-18 17:02:47

Latitude – N 43° 37.5469

Longitude – W 79° 40.3455

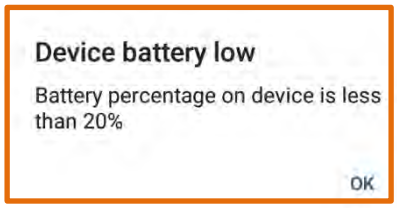
HAE altitude [m] – 141.8

Background status – OK

Anomaly background – OK

Device battery percentage – e.g., 100%

NOTE: If the device's battery drains to 20% or lower, a notification will appear on their acquisition device, notifying the user that it might be an appropriate time to charge the device *(refer to the Figure on the right)*.



NOTE: Android version displayed here. iOS Device Status page looks and functions the same.

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11.0 USING MEASUREMENT LOGS PAGE

11.1 Measurement Logs Page

The **Measurement Logs** provide users with a scrollable list of all scanning events for the **RadMobile App**. When a scan event is selected, dialog will appear briefly at the bottom of the screen to let the user know to rotate their acquisition device to view the spectra for the selected scan event.Information such as date and time are provided for each scan event. Scan events listed within the Measurements Log are colour coded *(shown below in the Figure to the left)* so that users can easily distinguish between alarm types (Neutron Alarms = **RED**, Gamma Alarms = **BLUE**, High Dose Alarms = **ORANGE**).

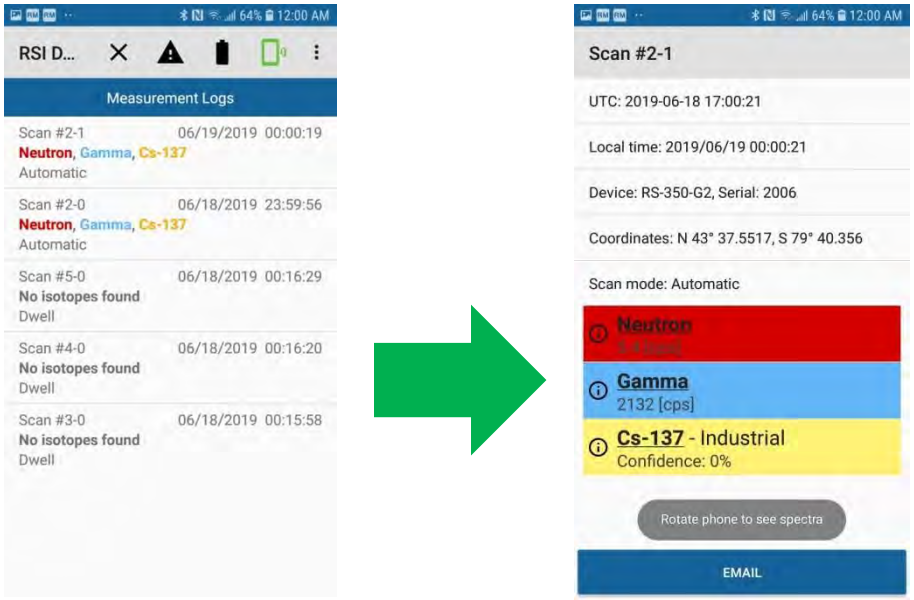

Figure A: Android Measurement Logs

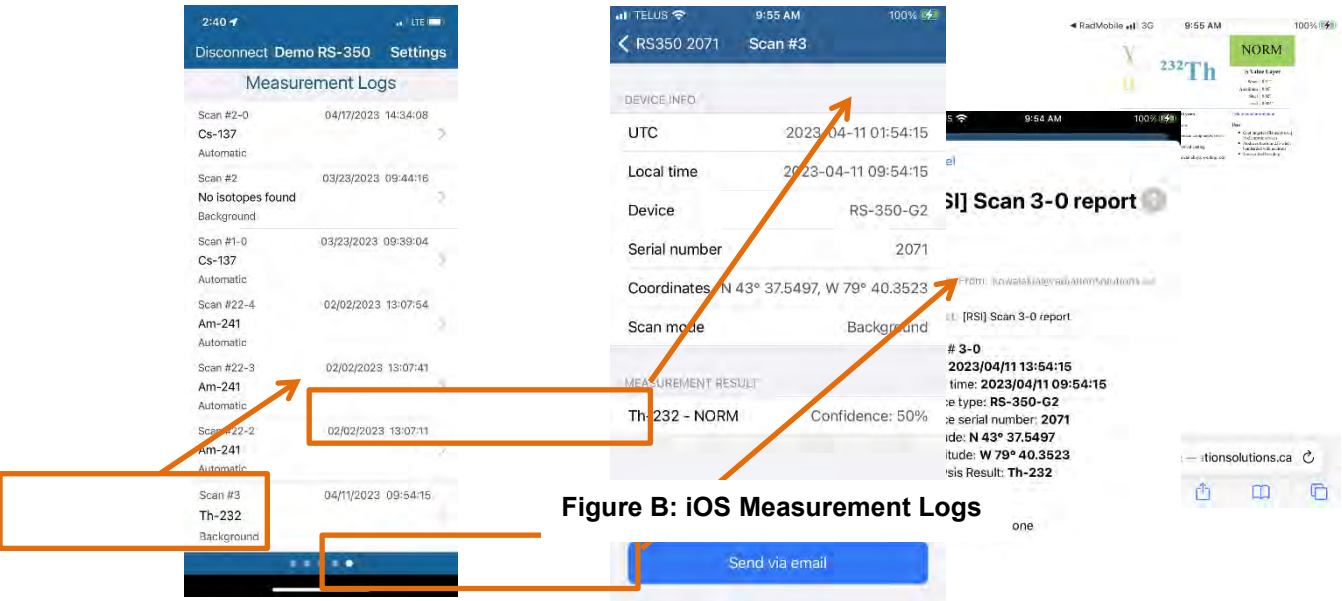

Figure B: iOS Measurement Logs

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12.0 PHONE DEVICE SPECIFICS

12.1 Phone Device Specifics

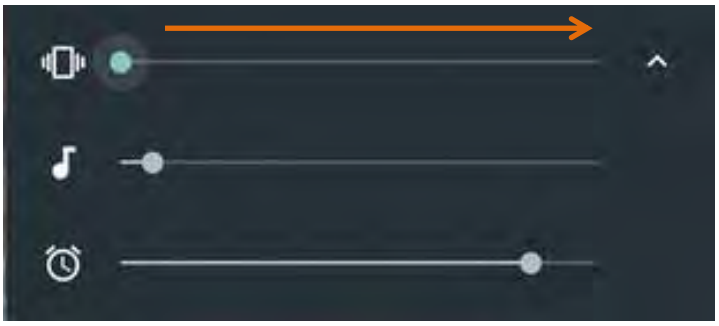
This Section outlines details of the **RadMobile App** that are specific to either the Android or iOS external device.

12.1.1 External Device Audio

ANDROID DEVICE:

AUDIO: INTERNAL – volume can be controlled by the volume buttons located on the side of your acquisition device as long as **Media Volume** has been enabled.

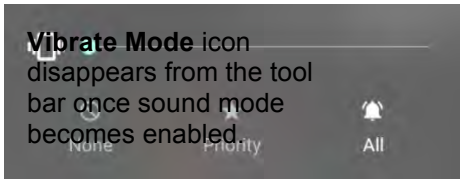
Enable Media Volume – Swipe to the right



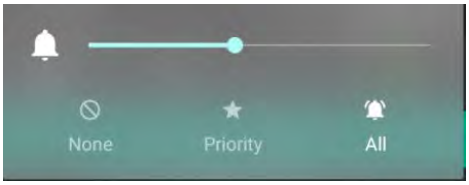
NOTE: To ensure that volume is enabled on your android external acquisition device for the application, open the **Settings** page for your external acquisition device and then open **Sound** and then **Volume**. Locate the **Media Volume** control *(shown above)* and set it to an appropriate level.

AUDIO: VIBRATE MODE – if more covert surveys are of importance to the user, the user can enable **Vibrate Mode** for their external acquisition device by lowering the **Media Volume** control until the **Vibrate Mode** icon *(as shown at the top of the next page)* appears. To get out of the **Vibrate Mode**, slide the **Media Volume** control slider to the **right**.

Vibrate Mode



Sound Mode

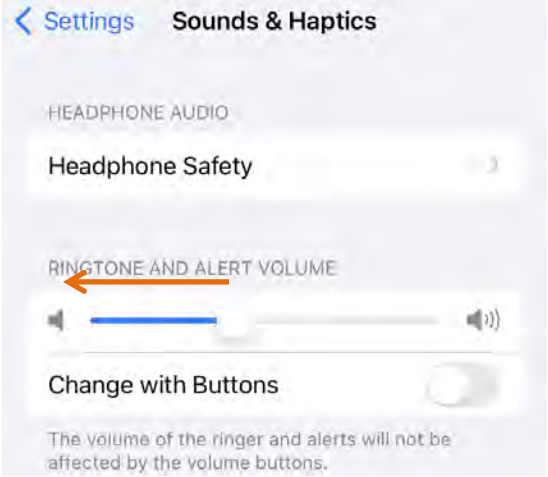


iOS DEVICE:

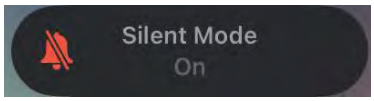
AUDIO: INTERNAL – volume can be controlled by the volume buttons located on the side of your acquisition device, from the front screen tool menu, or from the **Sounds and Haptics** page.

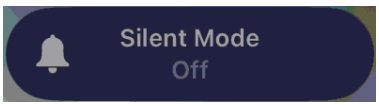
Front Screen Volume Control – Swipe UP or DOWN

NOTE: To ensure that volume is enabled on your iOS external acquisition device for the application, open the **Settings** page for your external acquisition device and then open **Sounds and Haptics**. Locate the **RINGTONE AND ALERT VOLUME CONTROL** and set it to an appropriate level *(shown to the right)*.



AUDIO: VIBRATE MODE – if more covert surveys are of importance to the user, the user can enable **Silent Mode** for their external acquisition device by lowering the **RINGTONE AND ALERT VOLUME** control until the **Silent Mode** icon *(as shown to the right)* appears. To get out of the **Silent Mode**, slide the **RINGTONE AND ALERT VOLUME** control slider to the **right**.

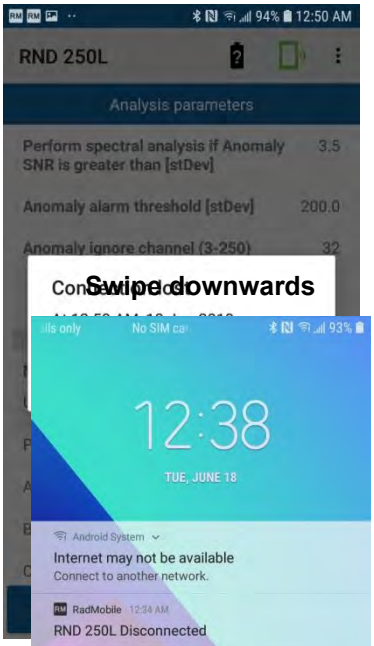




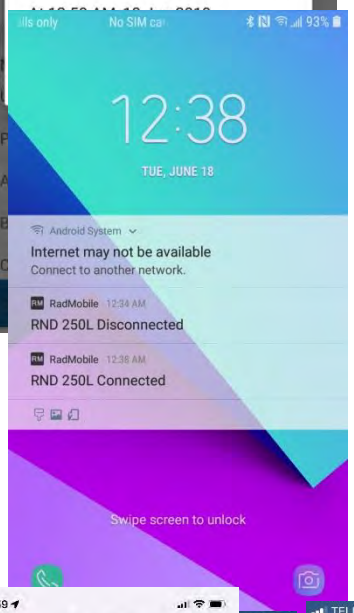
12.1.2 Device Notifications

ANDROID:

LOST CONNECTION NOTIFICATIONS:

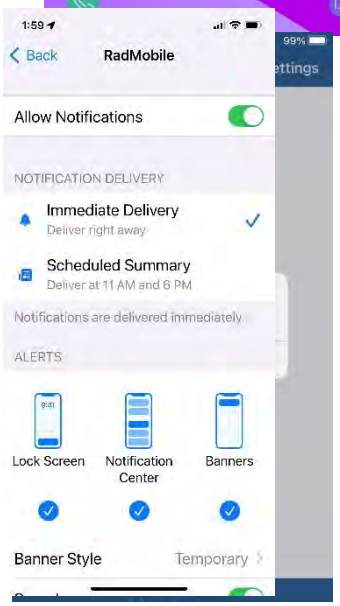


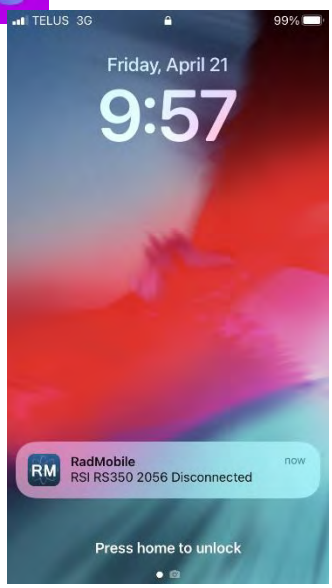
If at any time, there is a loss of communication between the system and the android device, a pop-up notification appears, that notifies the user of the lost connection as well as including the date and time of the lost connection. As long as **Silent Mode** has not been activated on the acquisition device, a loud audible tone will be heard by the user, following a disconnection, to alert the user to this event. The user touches the **OK** button to acknowledge the lost connection which silences the audio.



A log of lost connections and reconnections *(listing the date, time, and system name)* are stored on the acquisition device and can be displayed by swiping downwards from the top of the android device's screen. These notifications are kept until the user clears each notification individually or touches the **CLEAR ALL** button as shown in the Figure to the left.

iOS:





iOS users can enable Notifications for RadMobile through **Settings → RadMobile → Notifications**. From the Notification page, tap Allow Notifications (as shown) to Enable them for the device. Notifications will now appear in the lock screen and the home screen as shown to the left.

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13.0 DATA

13.1 Raw Data Retrieval

a) Take a USB memory stick *(each download uses approximately 45 Mb)*.

b) An **RSI** folder is created and automatically stored with the date and time.

c) With the RS-350 Backpack powered **ON**, insert the USB stick into either USB service port *(see the Figures below)*.

d) Data will immediately be transferred – wait for the flashing stick light to stop showing the completion of data transfer.

NOTE: The **STATUS LED** will flash **BLUE** while accessing the memory stick and turn **SOLID** once the transfer is complete.

RS-350 (A-1184)

NOTE: Download **RAW** data using a USB memory stick after every survey.

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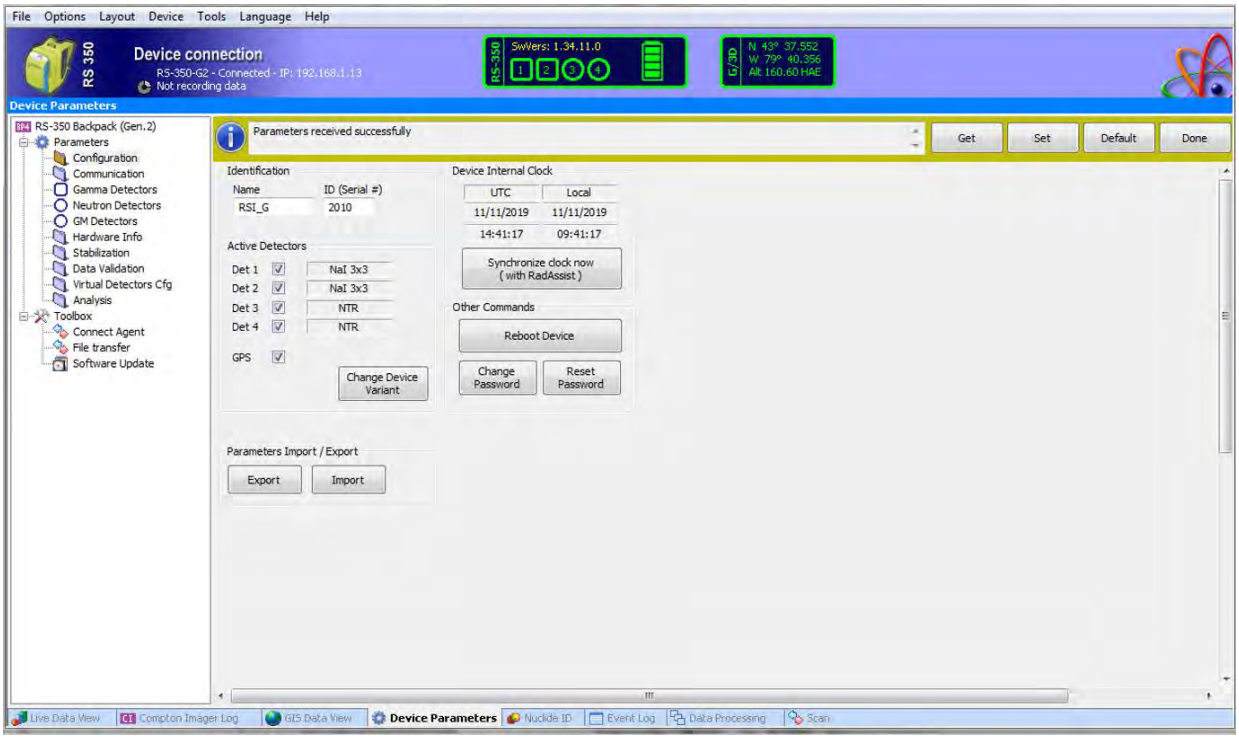
14.0 RADASSIST BACKPACK DEVICE PARAMETERS

14.1 Device Parameters

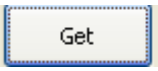
The Device Parameters page is used to change advanced parameters and for maintenance.

When the "**Device Parameters**" tab is selected the following screen appears:

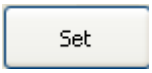


14.1.1 Action Buttons

The buttons at the top-right of the screen are used as follows:

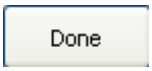


– retrieves the system parameters previously set for the system from the console and is required to populate displayed values. This operation must first be done before the user can view or modify the system parameters. The user can then adjust the parameters as required to suit their needs. Password is required.



– once the parameters are entered, click the **Set** button to load them into the console's flash memory. This means that from now on, unless the setup process is run again, the parameters will stay at their new **SET** value.

– **(DISABLED)** allows another connection to take control of parameters.

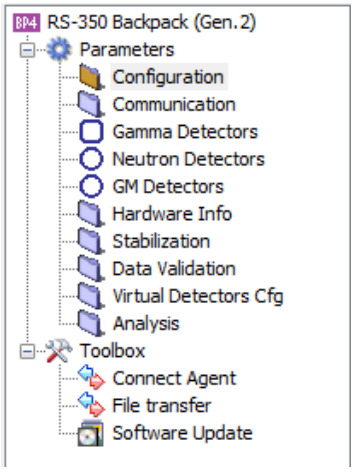


– terminates the **Parameter Setup** process.

NOTE: Once the parameters are modified a single **SET** command stores them all. The **Done** button is not typically used.

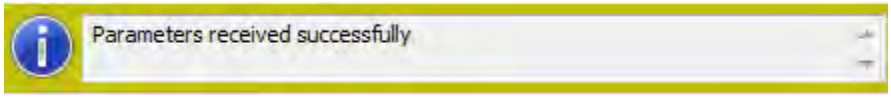
14.1.2 Parameter Selection

This screen displays various "**PAGES**" of Parameter Setup and automatically selects the **"Configuration"** page to start with.



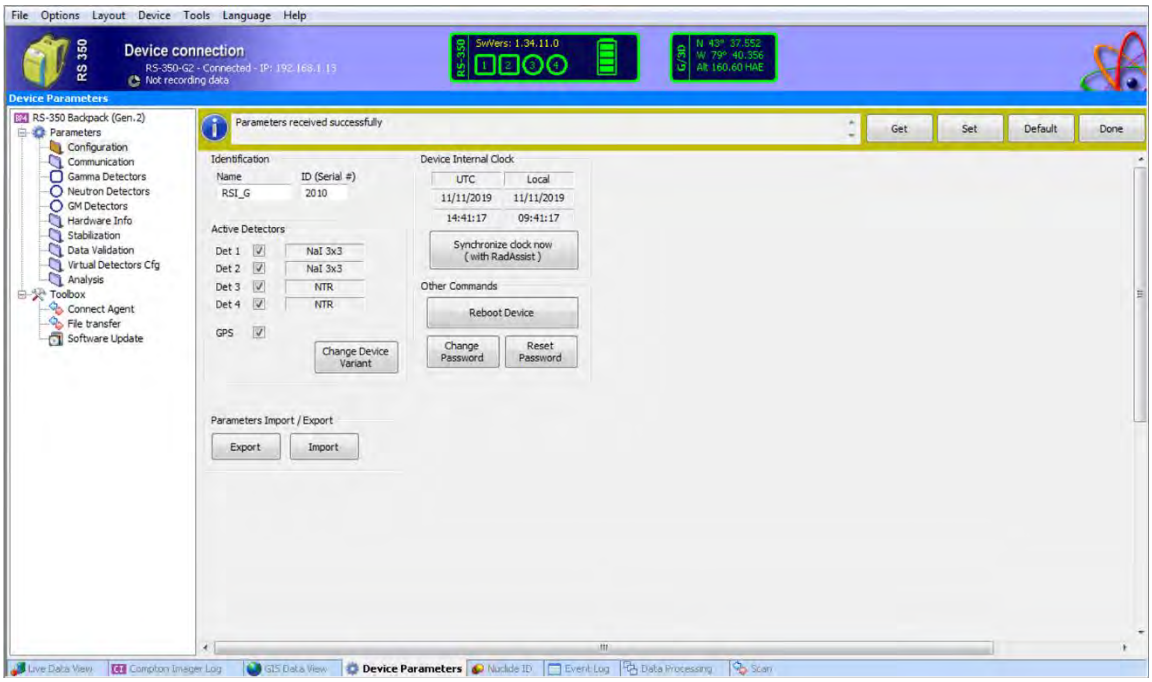
Load Current Parameters:

The message, "**Parameters received successfully**" displays to indicate that the action was carried out correctly; the data is then displayed on screen.



14.1.3 Configuration Page

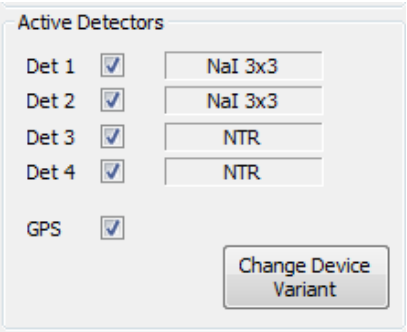
This is the first "**PAGE**" of the parameter setup and is automatically displayed when the "**Device Parameter**" tab is selected.

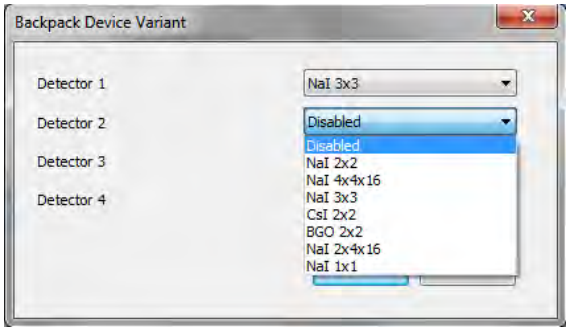


a) **Identification:**
Displays the "**Name**" and "**Serial Number**" connection details between the laptop and the console. Type your **USER NAME** into the "**Name**" data field and then click the **Set** button to store the data.

b) Active Detectors:

This indicates the detectors capability as well as the type of system. In the example shown above, there are four detectors connected to the system. Detector #1-2 are **Gamma Detectors**, while Detector #3-4 are **Neutron Detectors**. Not shown in the example are GM Detectors. The user can turn **ON/OFF** individual detectors by checking or unchecking the "**Active Detector**" checkboxes. Users can also change the detector type *(Gmm, GM or Ntr)* by clicking the **Change Device Variant** button and selecting a different detector from one of the four drop-down menus as shown below. GPS can also be enabled/disabled by checking or unchecking the GPS checkbox.

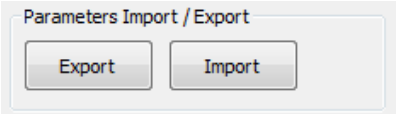




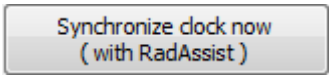
NOTE: The "**Change Device Variant**" button is only available while using the appropriate "**RA-Service**" license. Using this button changes the detector configuration.

c) Parameters Import/Export:

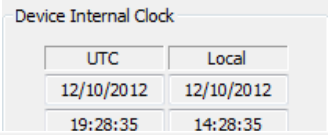
Clicking the Export button opens a new window to save and export a parameter file. Clicking the Import button opens a new window to load and import a parameter file.



d) Device Internal Clock:

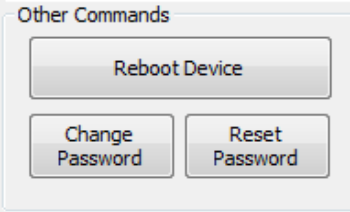


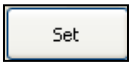
Synchronize clock now (with RadAssist) – synchronizes the RS-350 **Device Clock** with the laptop.



e) Other Commands:

Clicking the **Reboot Device** button will reboot the backpack device. Clicking the **Change Password** button opens a new window. Users must enter their old password, their new password, and then confirm their new password before clicking the **Update** button. Clicking the **Reset Password** button resets the password to its original default setting.

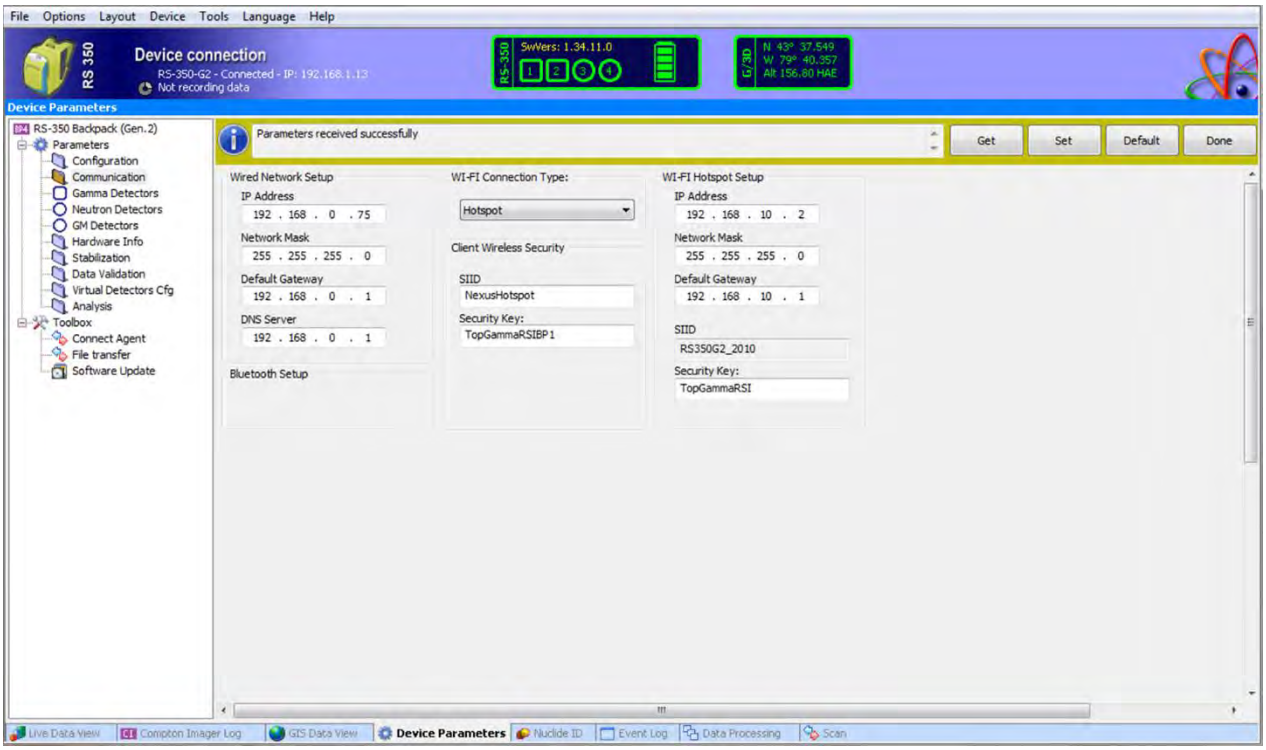


After any changes, click the 

button to store these parameters into system memory.

14.1.4 Communication Page

The **Communication** page permits the user to setup the backpack device as either a **HotSpot** or **Client** connection for use between the RadMobile App and an external acquisition device.



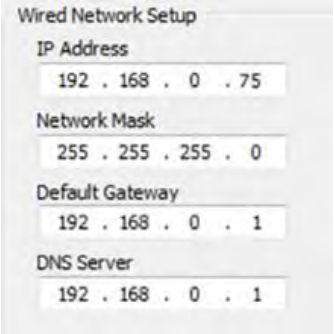
a) Wired Network Setup:

IP Address – the address of the **ETHERNET** connection between the laptop and the device.

Network Mask – the mask of the **ETHERNET** connection between the laptop and the device.

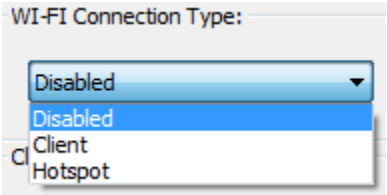
NOTE: The user can change the IP Address and the Network Mask to suit.

*See your Network Administrator to enter the correct Static IP Addresses for **Default Gateway** and **DNS Service**.*



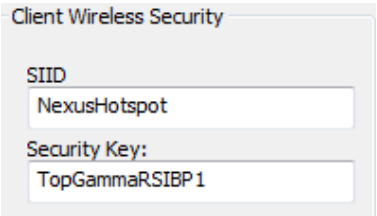
b) Wi-Fi Connection Type:

The Wi-Fi Connection Type is a drop-down menu that permits the user to select whether the backpack device will act as a wireless hotspot or client.

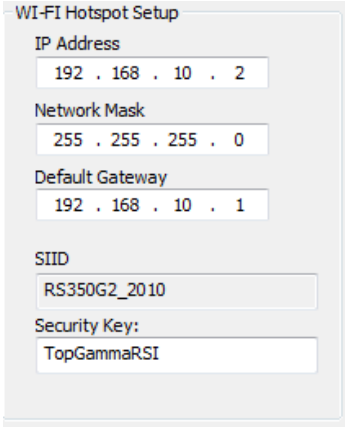


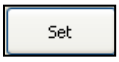
c) Client Wireless Security:

Permits the user to select an SSID Name and Security Key for the backpack device when it is being setup as a wireless client device.



d) Wi-Fi Hotspot Setup:
Setup the IP Address, client DHCPNetwork Mask, Default Gateway, and Security Key for the backpack when it is being used as a wireless hotspot.

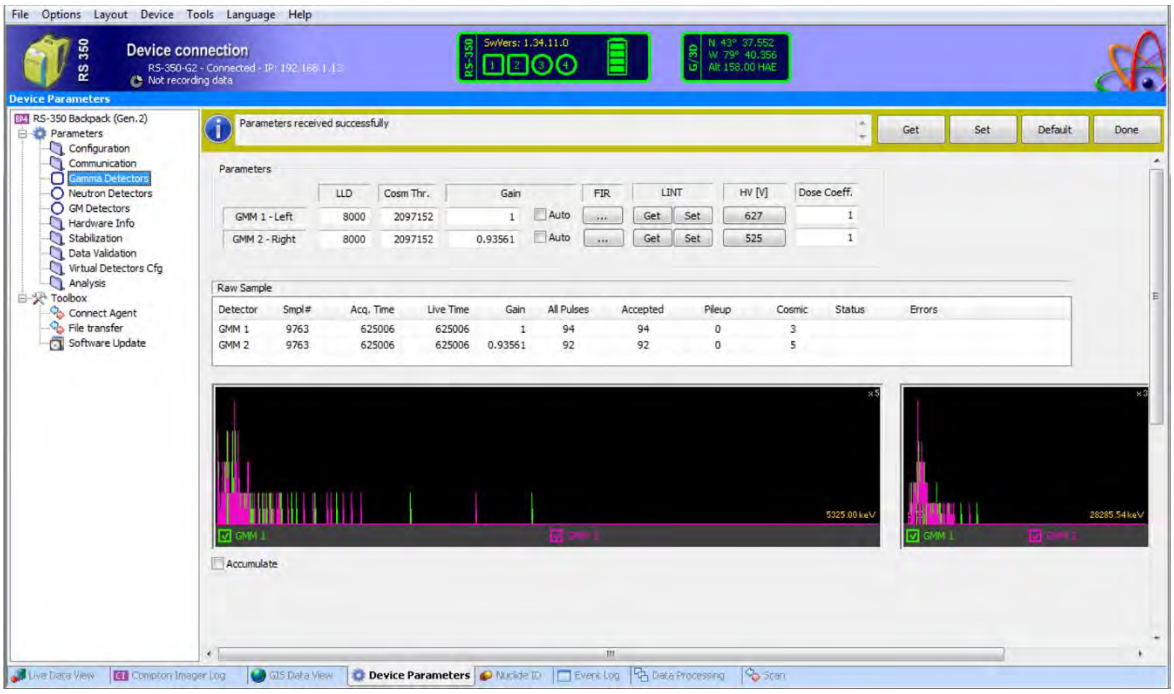


After any changes, click the 

button to store these parameters into system memory.

14.1.5 Gamma Detectors Page

When this page is selected, the following screen appears as shown below. This page is used primarily for maintenance.



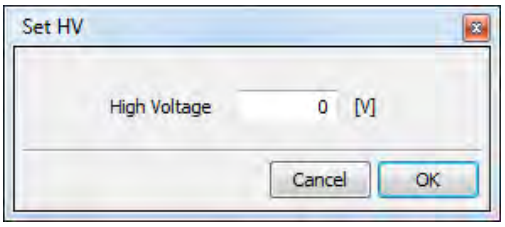
LLD (Lower Level Discriminator) – controls the low level noise cut-off. Set to reduce noise at low energy of the spectrum (**DEFAULT** = 8000).

Cosm Thr. – defines the threshold for cosmic radiation (**DEFAULT** = 2097152).

Gain – the current Gain Setting. The nominal correct Gain Range is between **0.85 – 1.15**, but the **Automatic Gain Stabilization System** changes the **GAIN** as required to compensate for temperature and aging effects in the detector. Anything outside this range requires an HV Calibration.

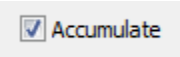
Automatic Gain Stabilization:

Permits automatic Gain Stabilization.

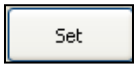


Set HV… – permits the user to change the HV Setting for special adjustments as required. A pop-up window opens permitting changes to the HV. Click the **OK** button to save. The HV changes after a few seconds, but only for the selected detector. The new value is shown in the **High Voltage** window.

Accumulation Data:



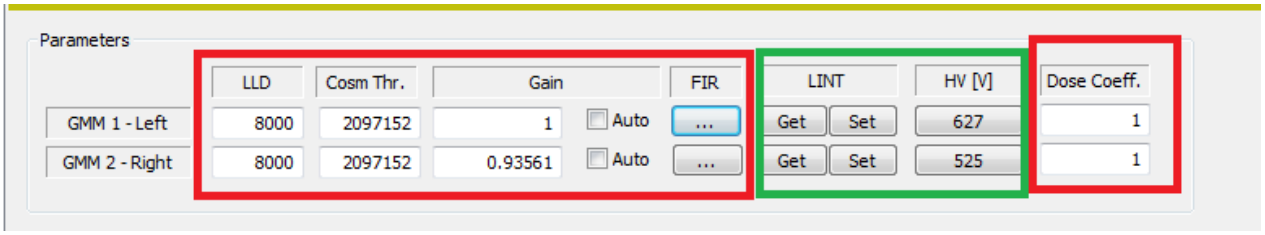
Check marking the "**Accumulate**" checkbox permits spectrum accumulation for special testing, for instance adjusting the HV. HV should be set so for a fixed gain of 0.95, Cs-137 662 keV peak sits in channel 440:

After any changes, click the 

button to store these parameters into system memory.

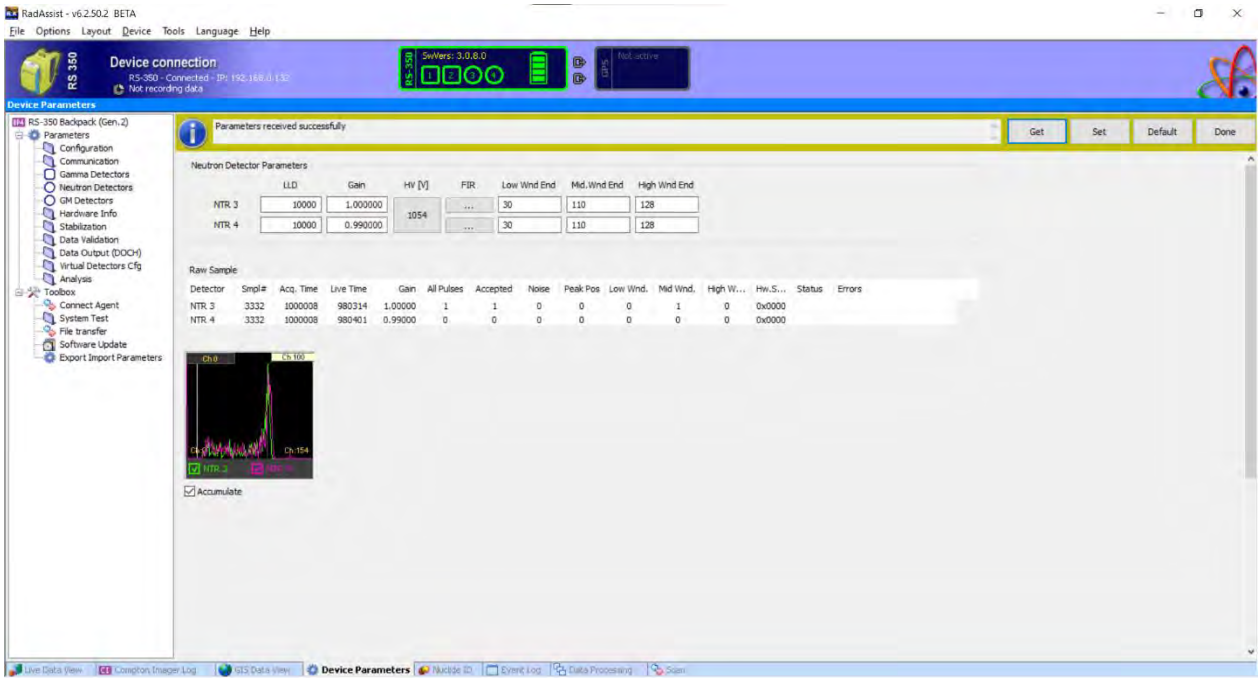
NOTE: The Backpack CPU will overwrite most of the Gamma Parameters at startup. Only the High Voltage (HV) and the LINT Table will be stored in flash memory.

- **RED** – stored in the CPU and overwrites the Gamma Parameters at startup.
- **GREEN** – Gamma Parameters stored in the flash memory.

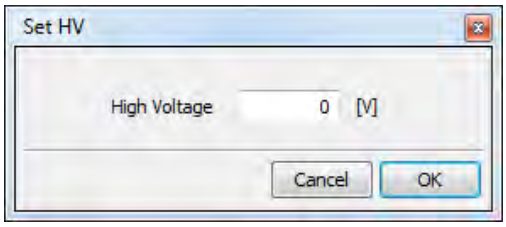


14.1.6 Neutron Detectors Page

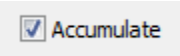
When this page is selected, the following screen appears as shown below. This is a user information page that permits the user to view the operating parameters and see that the neutron detectors are operating.



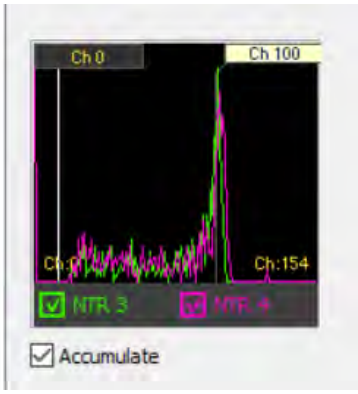
Set HV… – permits the user to change the HV Setting for special adjustments as required. A pop-up window opens permitting changes to the HV. Click the **OK** button to save.

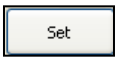


Accumulation Data:



Check marking the "**Accumulate**" checkbox permits spectrum accumulation for special testing such as changing the HV. Neutron peak should sit in channel 100.

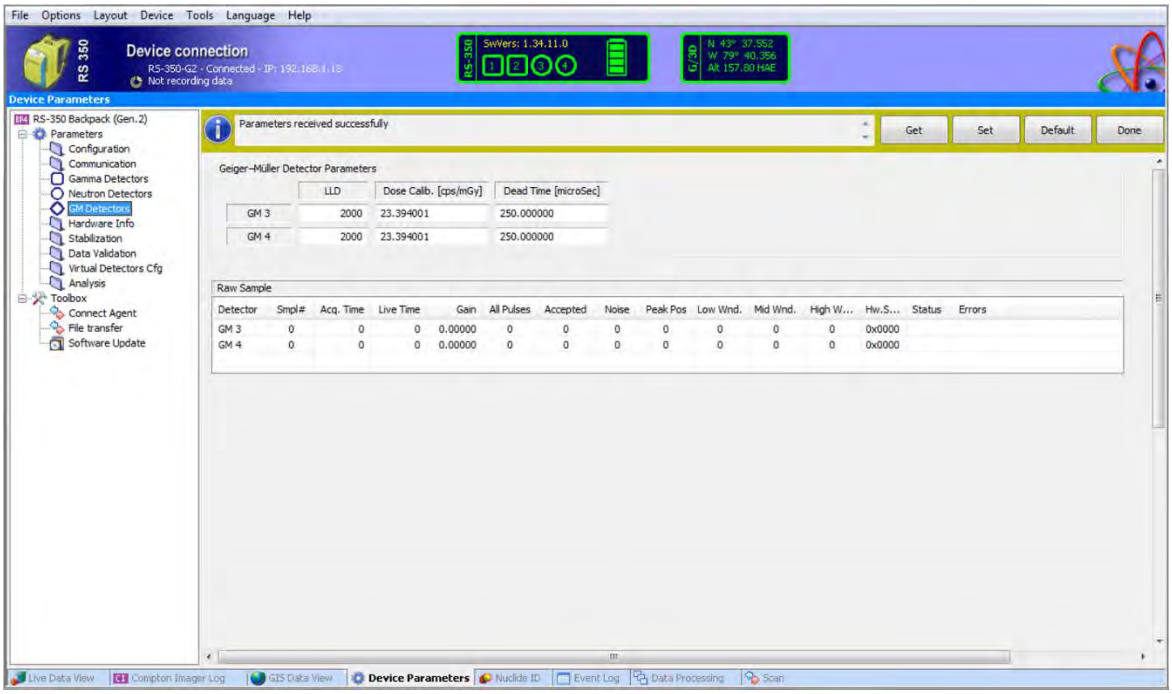


After any changes, click the 

button to store these parameters into system memory.

14.1.7 GM Detectors Page

When this page is selected, the following screen appears as shown below. This is a user information page that enables the user to view the operating parameters and see that the GM detectors are operating.

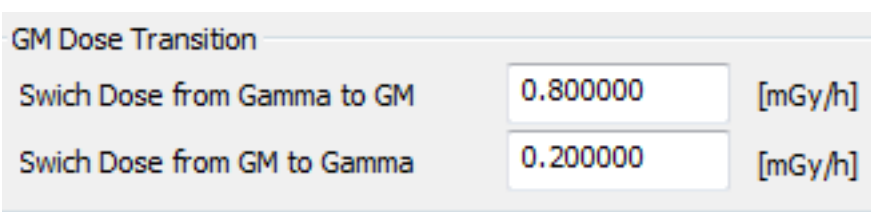


GM Board – Raw Sample:

Displays the current Raw Sample Data for the GM tubes.

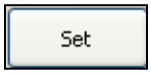
GM Dose Transition:

While using the backpack device with the RadMobile App, the app displays only **ONE** dose value. The backpack decides which dose to send to the app based on hysteresis. The transition from Gamma Dose to GM Dose and then back again is defined by two thresholds.



Switch Dose from Gamma to GM – if the dose value meets or exceeds e.g. 0.8 [mGy/h], the dose value switches from Gamma to GM.

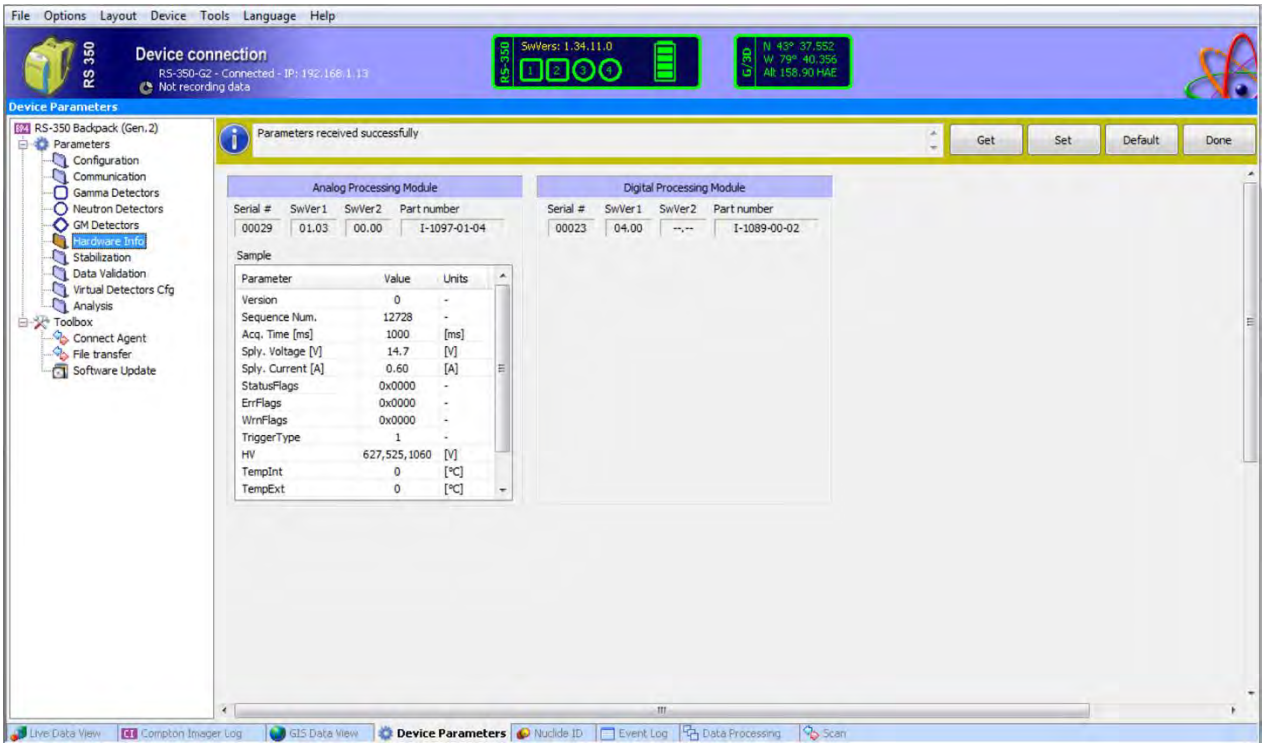
Switch Dose from GM to Gamma – if the dose value drops to e.g. 0.2 [mGy/h] or lower, the dose value switches from GM to Gamma.

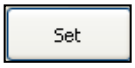
After any changes, click the 

button to store these parameters into system memory.

14.1.8 Hardware Info Page

When the **Hardware Info Page** is selected, the screen as shown below displays. This page displays information regarding the **Analog and Digital Processing Modules** including their **Serial Number**, **Software Versions**, and **Part Numbers**. **Raw Sample Data** is also displayed for the **Analog Processing Module** as shown in the Figure below.

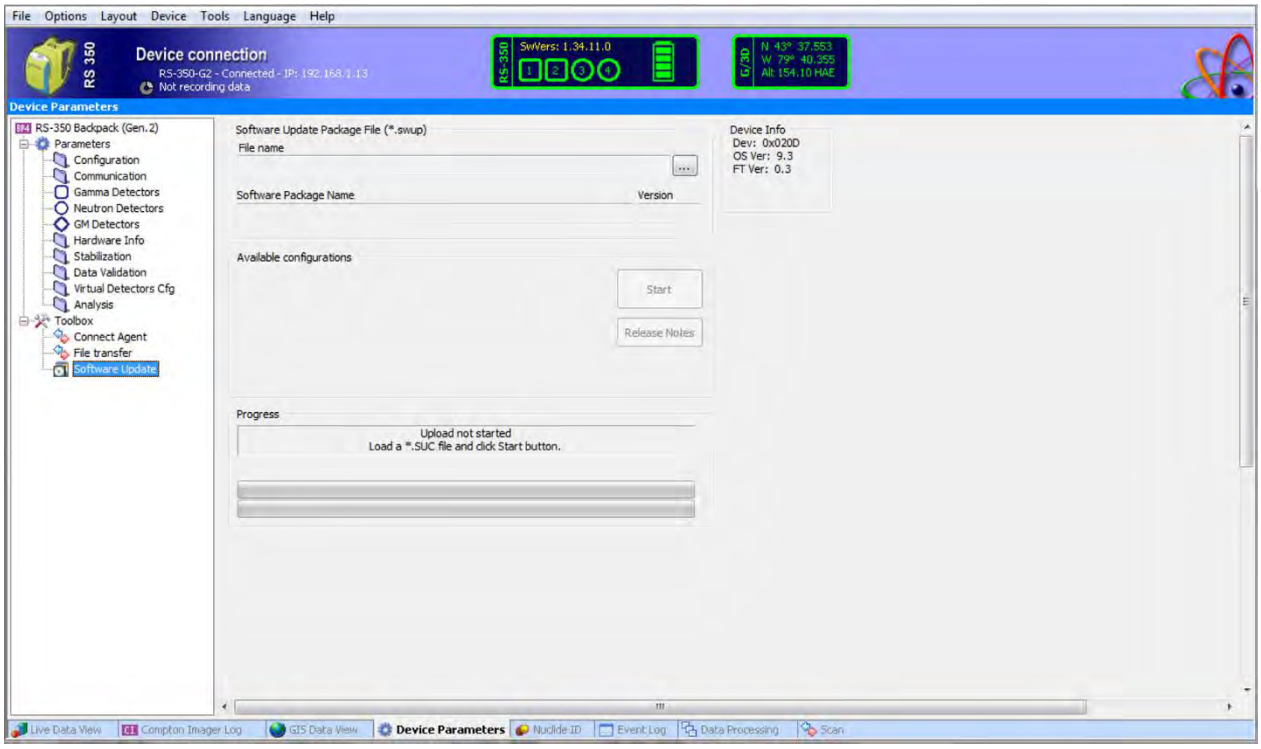


After any changes, click the 

button to store these parameters into system memory.

14.1.9 Toolbox – Firmware Update

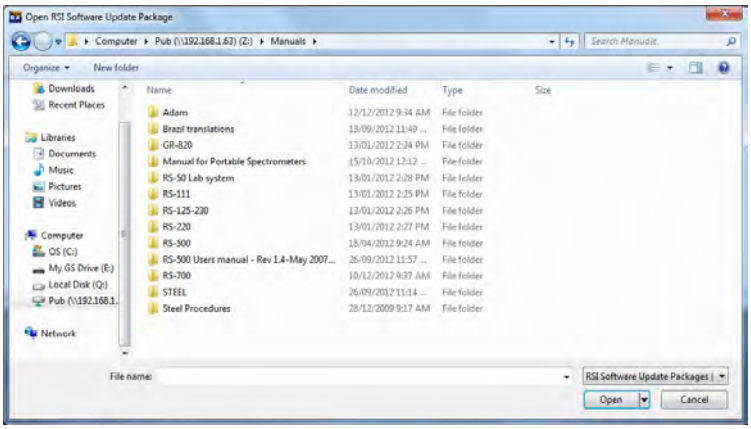
When **Software Update** is selected, the page as shown below appears:



Update:

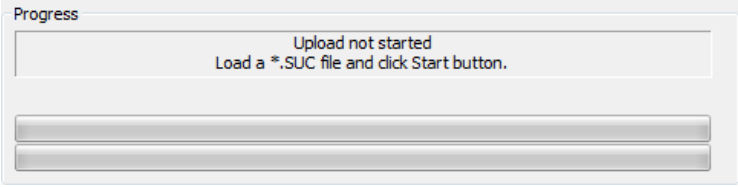
To browse for an update file, click the ... button. A browser window opens. Select the **(*.swup)**.

Highlight the desired **(*.swup)** file and click the **Open** button.



Progress:

The Progress Bar displays the Update Status and informs the user upon completion.



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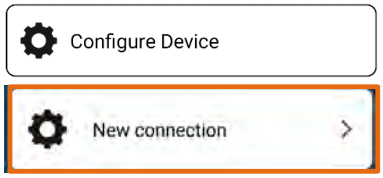
APPENDIX A – QUICK START

Connection to a New Device



Reconnecting to the Previous Device

One-click

Phone Status

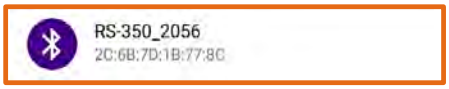
Device Battery

Connection Type

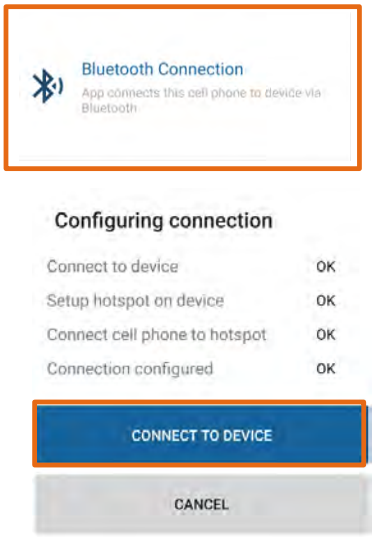
Device Status

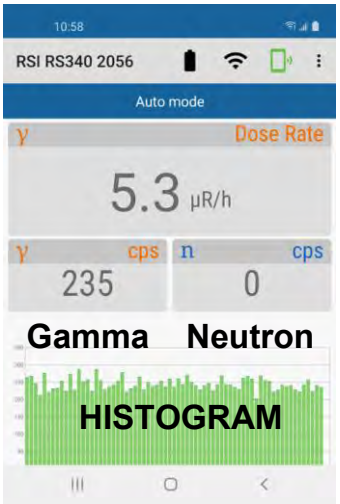
Menu

Select the Device from the List

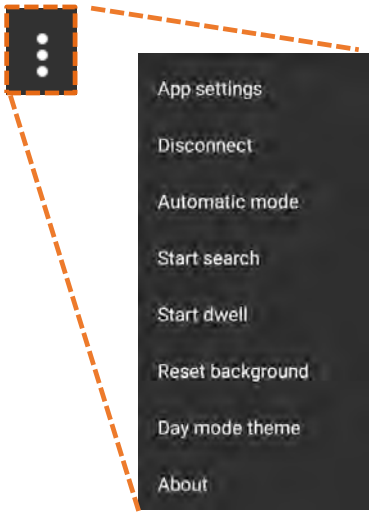


Select the Connection Type

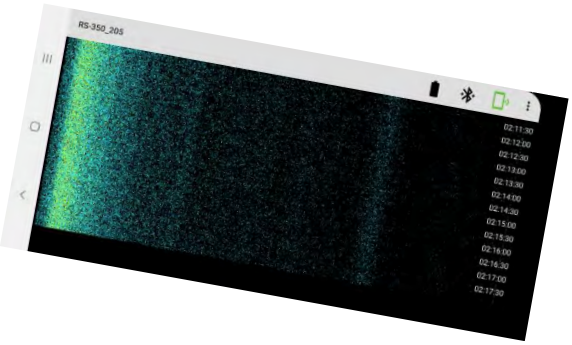




Menu → Click the 3 Dots



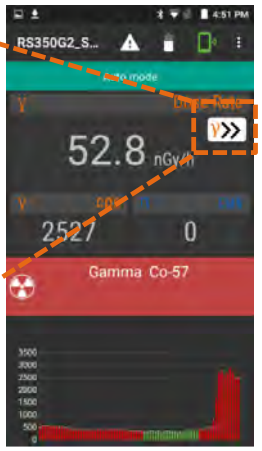
Rotate the Phone to View the Waterfall Display



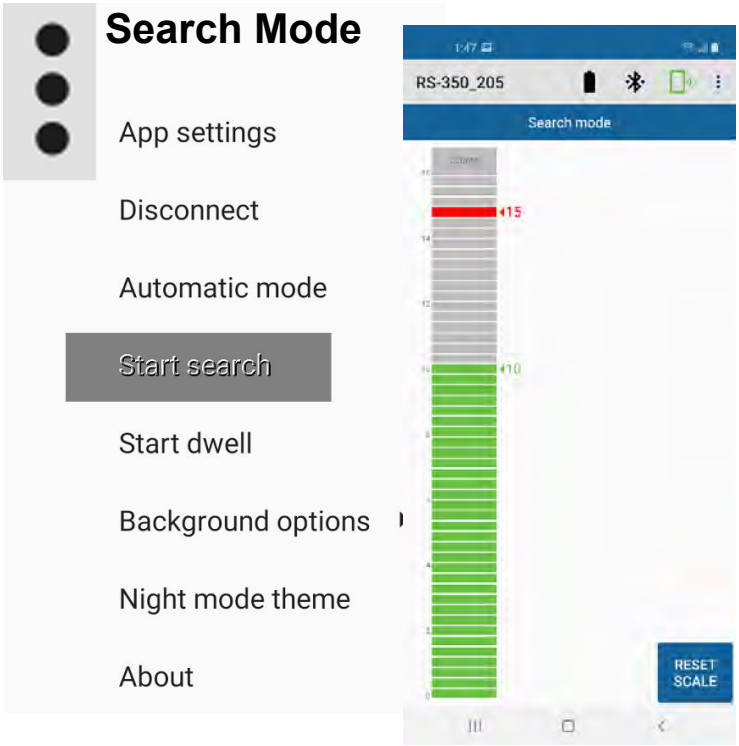
Gamma Right

Gamma Left

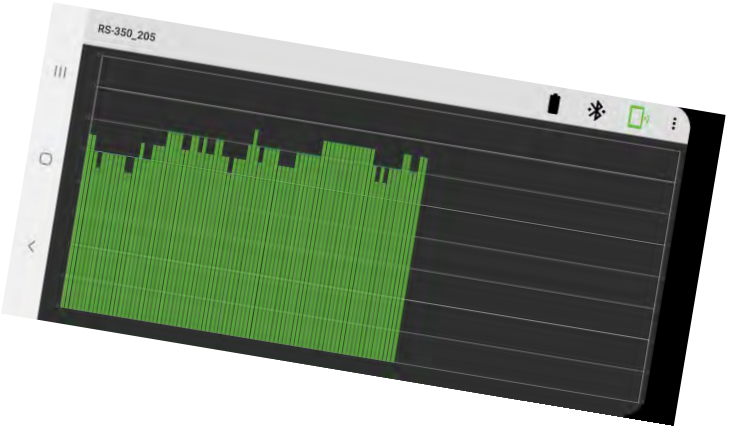
Indicates the direction of the activity



Search Mode



Rotate for the Histogram



Swipe Banner LEFT/RIGHT for More Screens: GIS, Analysis Parameters, Status, and Logs

NOTE: Regarding the system's battery, the battery has been discharged prior to shipping and should be charged fully before use.

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APPENDIX B – FCC/ISED Statement

CAUTION: Changes or modifications not expressly approved by Radiation Solutions Inc could void the user's authority to operate the equipment.

FCC

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 operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

FCC Radio Frequency (RF) Exposure Information and Statement

This device meets the government's requirements for exposure to radio waves. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons regardless of age or health.

This device has been tested and complies with the FCC RF exposure SAR (Specific Absorption Rate) limits for general population/uncontrolled exposure for body-worn operations

The device is designed to be used carried on the back of the user or set up on the ground or on a survey tripod. The end user is not to open the electronic assembly or modify the antenna. The end user is not to use the backpack device if the electronic box has been tampered with or the antenna has been changed.

ISED

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference;
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) L'appareil ne doit pas produire de brouillage;
(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

ISED RF Exposure Information and Statement

This device has been tested and complies with the ISED RF exposure SAR (Specific Absorption Rate) limits for general population/uncontrolled exposure for body-worn operations

Cet appareil a été testé et est conforme aux limites du débit d'absorption spécifique (DAS) fixées par ISDE pour la population générale / l'exposition non contrôlée pour les dispositifs portés sur le corps.

If this device is to be operated in the 5.15~5.25GHz frequency range, it is restricted to indoor environments only.

FCC and ISED Identification:
The device contains the following:
HVIN: SX-SDPAC
FCC ID: 2BHJ6-SDPAC
IC: 32789-SDPAC

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APPENDIX C – TROUBLESHOOTING

C.1. Android Battery Optimization

To maintain a constant Bluetooth connection between the RadMobile software application and the RS-350 Backpack system *(or any other RadMobile system)*, please follow the steps below to configure the battery optimization for an Android smartphone.

NOTE: Due to the limitations of mobile platforms, Android operating systems (OS) manage the use of resources to optimize battery life by imposing power restrictions on applications when the device is not charging.

A. KEEPING RADMOBILE APP PROCESS ALIVE WHEN SCREEN LOCKED

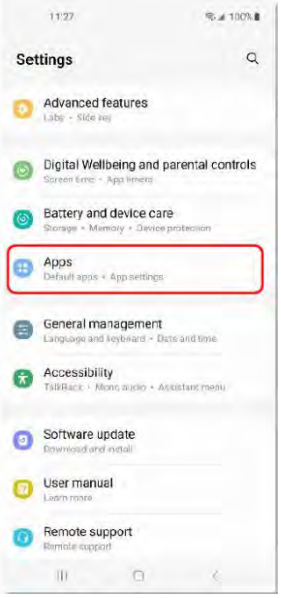
One of the key steps to keeping the RadMobile app running and maintaining a constant Bluetooth connection with the RS-350 Backpack system *(or any other RadMobile system)*, is to bring the RadMobile app to the foreground before locking a screen.

This means that when a screen needs to be locked, or when an Android device is left inactive for a while, the display will turn off and the Android device will be more likely to keep the RadMobile app functioning properly; especially if RadMobile is brought on screen first. Afterwards, an Android screen can be locked or left inactive until the screen turns off automatically.

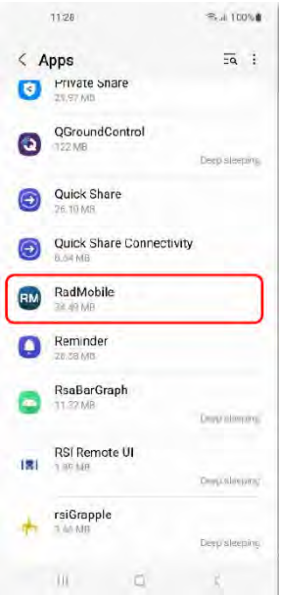
To bring the RadMobile app on screen, the user can either touch the RadMobile app icon from the Android's home screen. They can locate it within the Apps list, or they can touch the RadMobile app view from the Recent Apps

NOTE: Ensure that the RadMobile app is connected to the RS-350 Backpack *(or any other RadMobile system)* before locking the screen.

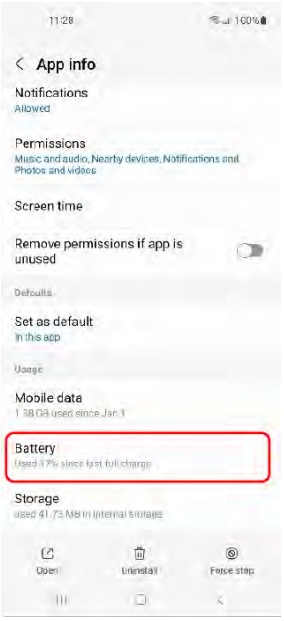
B. CONFIGURE BATTERY OPTIMIZATION FOR RADMOBILE APP



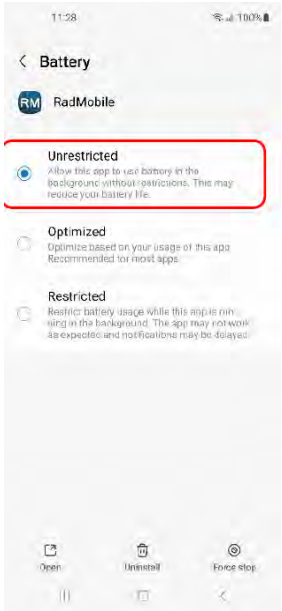
1. To configure the battery optimization for the **RadMobile** app, first go to the device's **Settings** page and select "**Apps**" as shown in the Figure to the right.



2. The **Apps** screen opens. Select "**RadMobile**" from the **Apps** list as shown in the Figure to the right.



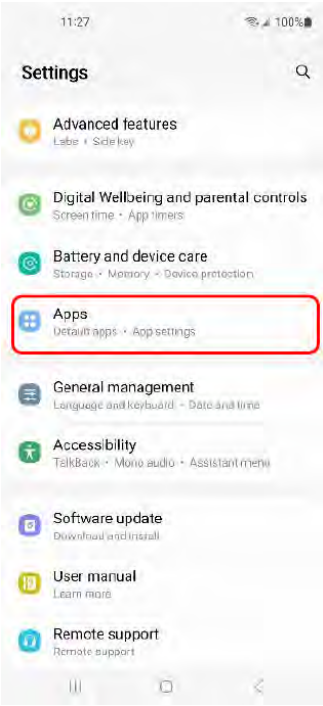
3. The **App info** screen opens for the RadMobile app. From the **App info** list select "**Battery**" as shown in the Figure to the right.



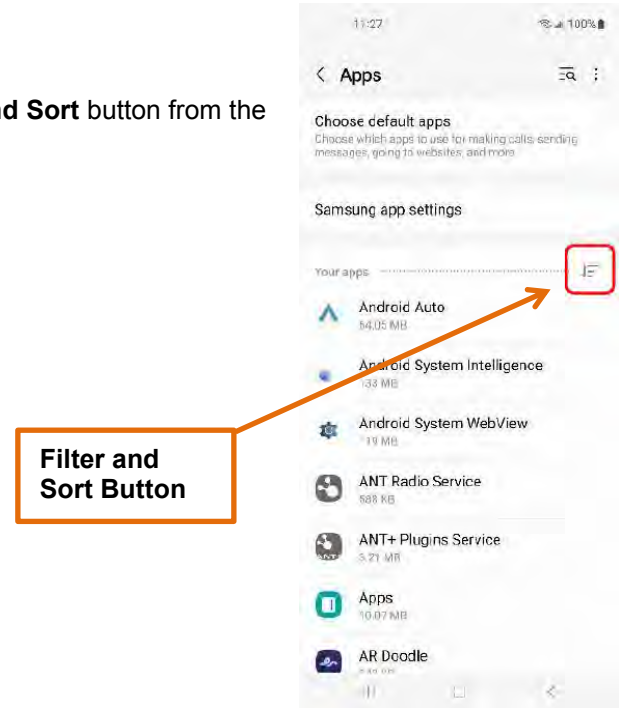
4. The **Battery** screen opens for the RadMobile app. From the list of three radio button options, select "**Unrestricted"** as shown in the Figure to the right.

C. CONFIGURE BATTERY OPTIMIZATION FOR BLUETOOTH APP

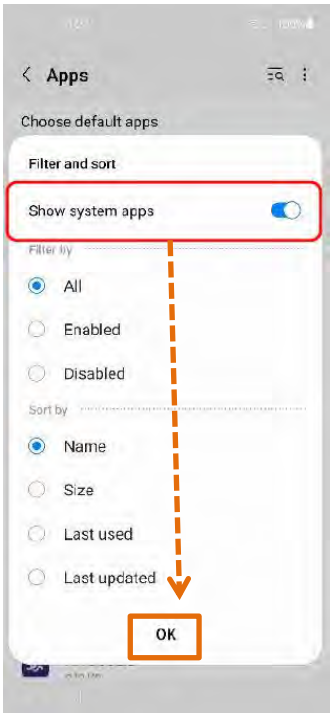
1. To configure the battery optimization for the Bluetooth app, first go to the device's **Settings** page and select "**Apps**" as shown in the Figure to the right.



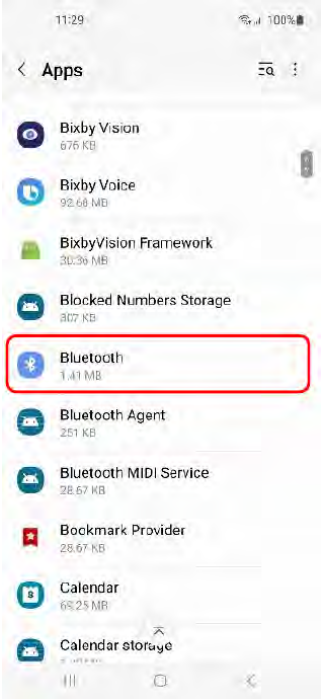
2. The **Apps** screen opens. Touch the **Filter and Sort** button from the **Apps** list as shown in the Figure to the right.



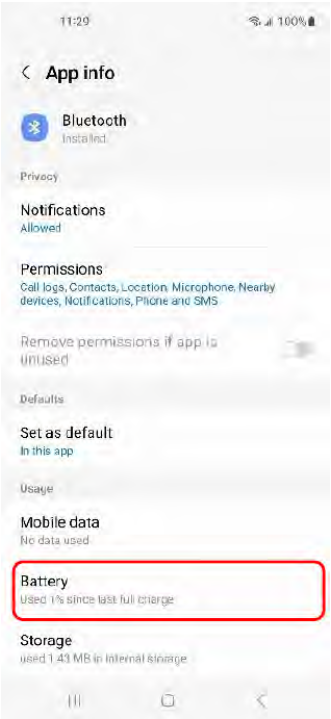
3. The **Filter and sort** pop-up window opens. Enable "**Show system apps**" from the **Filter and Sort** list and then touch the **OK** button, as shown in the Figure to the right.



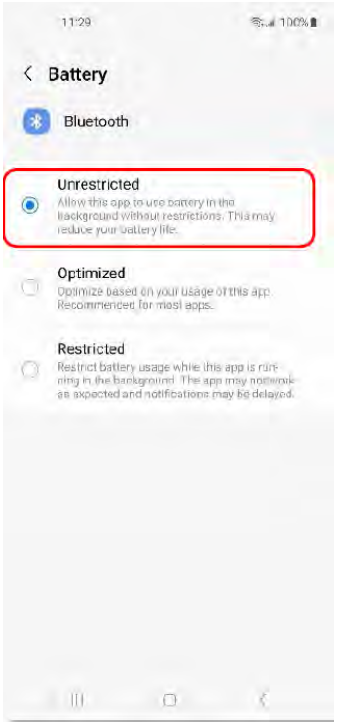
4. The user returns to the Apps screen. From the Apps list select Bluetooth as shown in the Figure to the right.



5. The **App info** screen opens for the **Bluetooth** app. From the **App info** list select "**Battery**" as shown in the Figure to the right.

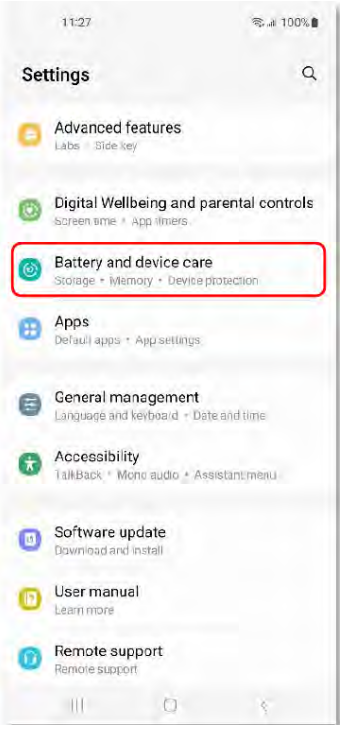


6. The **Battery** screen opens for the **Bluetooth** app. From the list of three radio button options, select "**Unrestricted"** as shown in the Figure to the right.

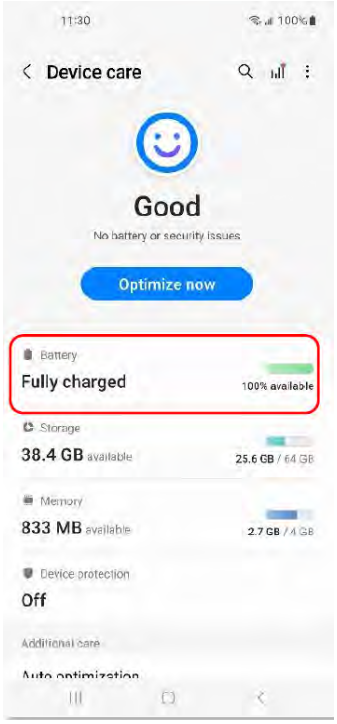


D. PREVENT PUTTING UNUSED APPS TO SLEEP

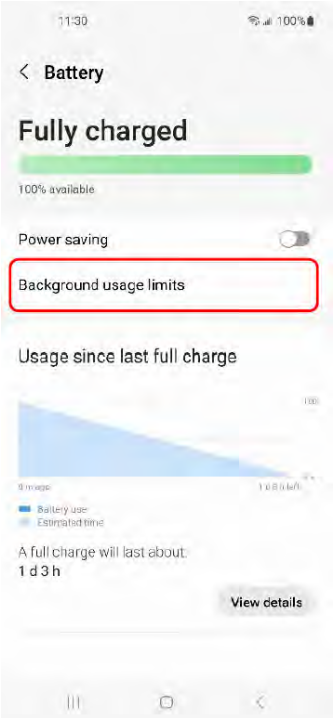
1. To prevent putting any unused apps to sleep, first go to the device's **Settings** page and select **Battery and device care** as shown in the Figure to the right.



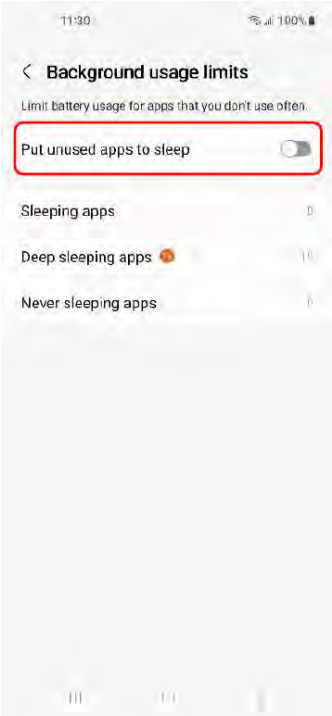
2. The **Device care** screen opens. Select "**Battery**" from the list of **Device care** options as shown in the Figure to the right.



3. The **Battery** screen opens. Select "**Background usage limits**" from the list of **Battery** options as shown in the Figure to the right.

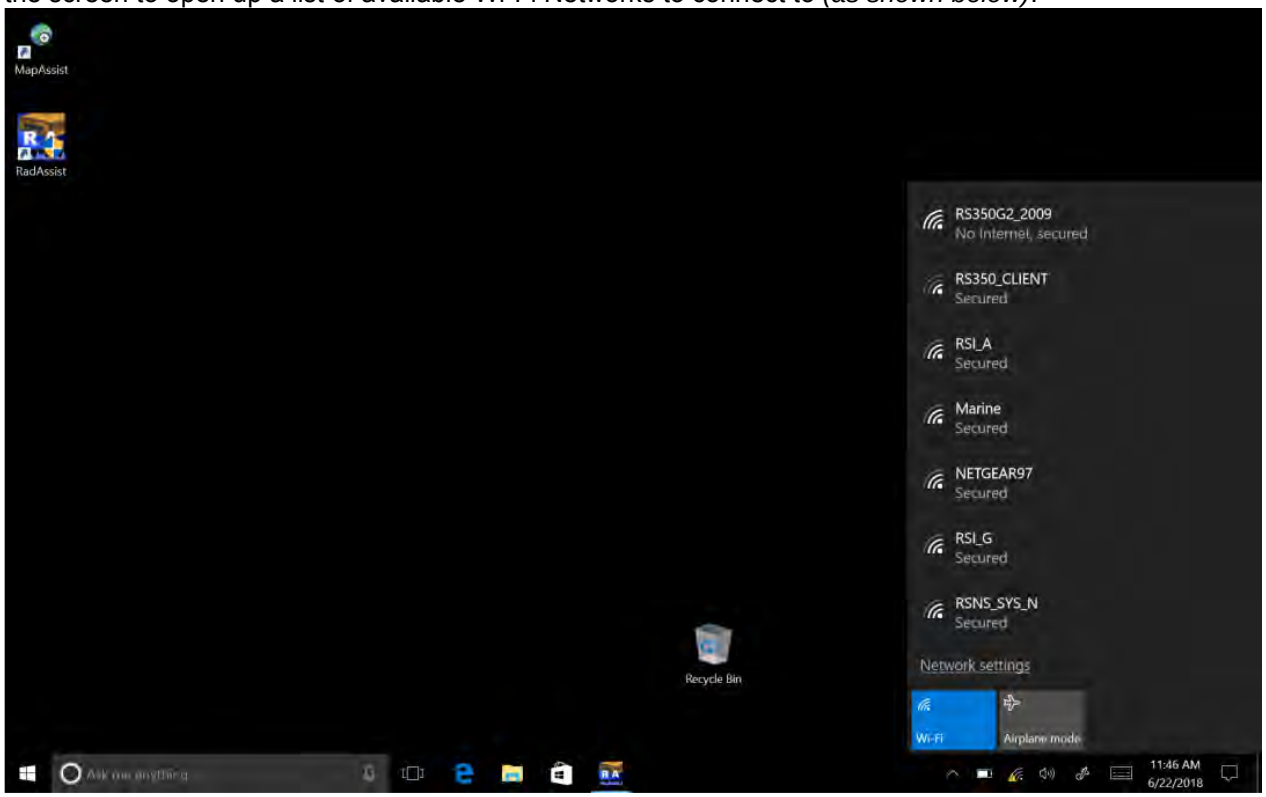


4. The **Background usage limits** screen opens. Disable **Put unused apps to sleep** from the **Background usage limits** list of options as shown in the Figure to the right.



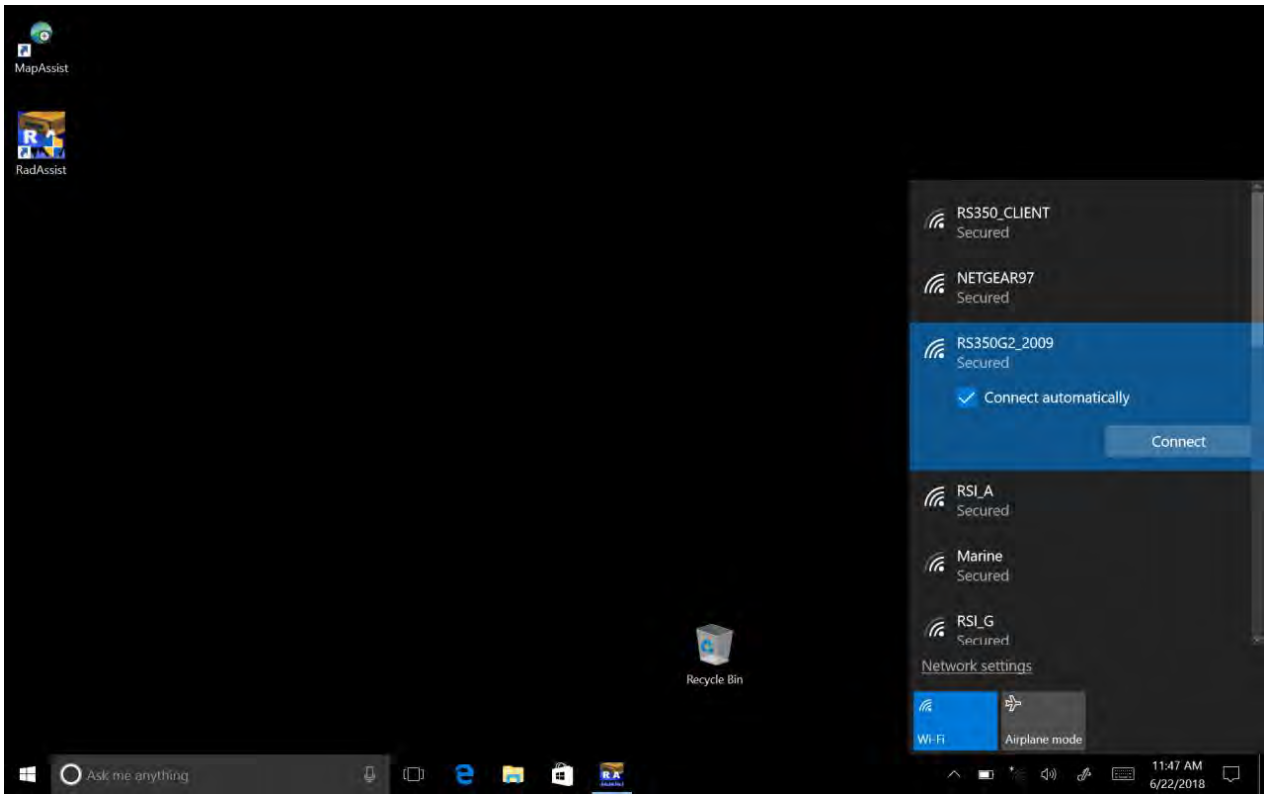
C.2 RS-350 Wi-Fi Connection to a Tablet (Using RadAssist)

For first time Users setting up a Wi-Fi connection between a tablet and the RS-350 Backpack:
1. From the tablet's main desktop, tap the **Wi-Fi Network** icon located in the bottom right-hand corner of the screen to open up a list of available Wi-Fi Networks to connect to *(as shown below)*:



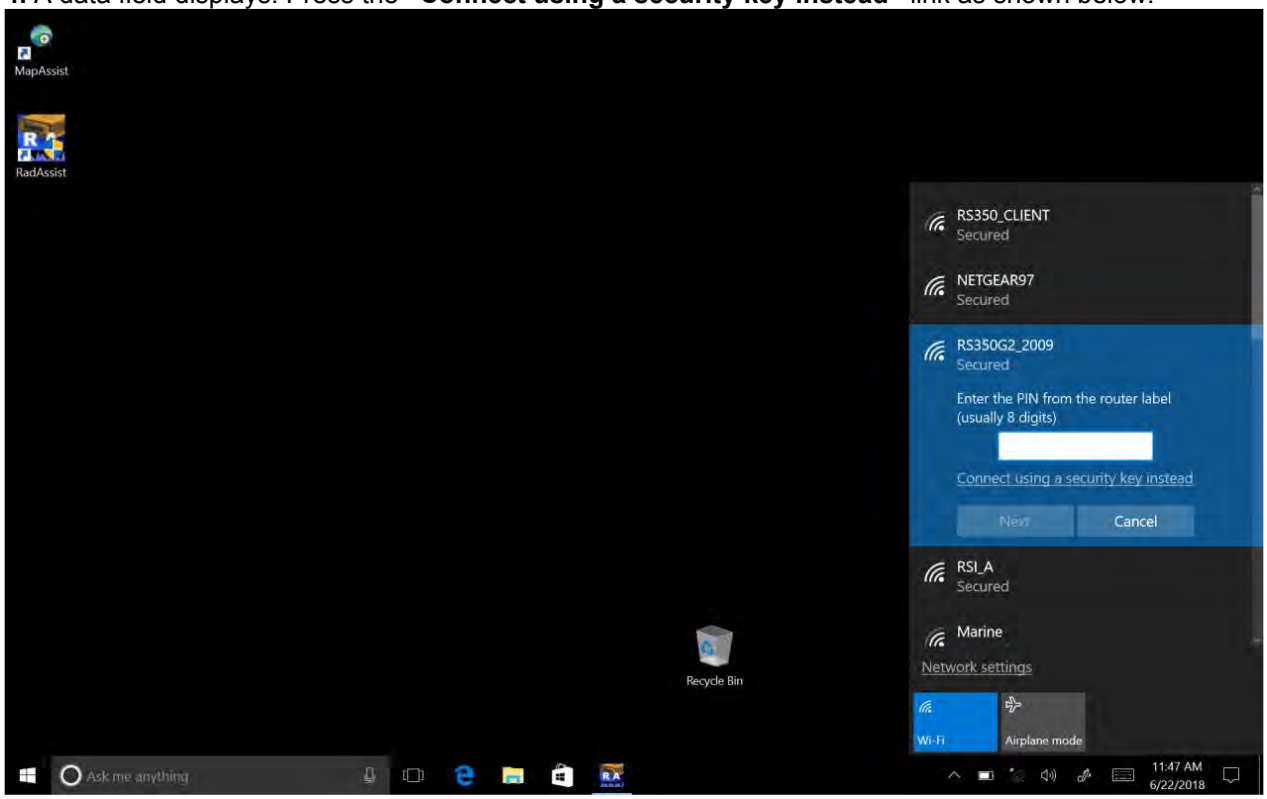
2. Select the required **RS-350 Wi-Fi Network Hotspot** from the list of available networks as shown above. For this example, **RS350G2_2009** was selected from the list of available networks.

NOTE: If **NO** available Wi-Fi Networks are displayed within this list, ensure that your Wi-Fi is **ENABLED**.

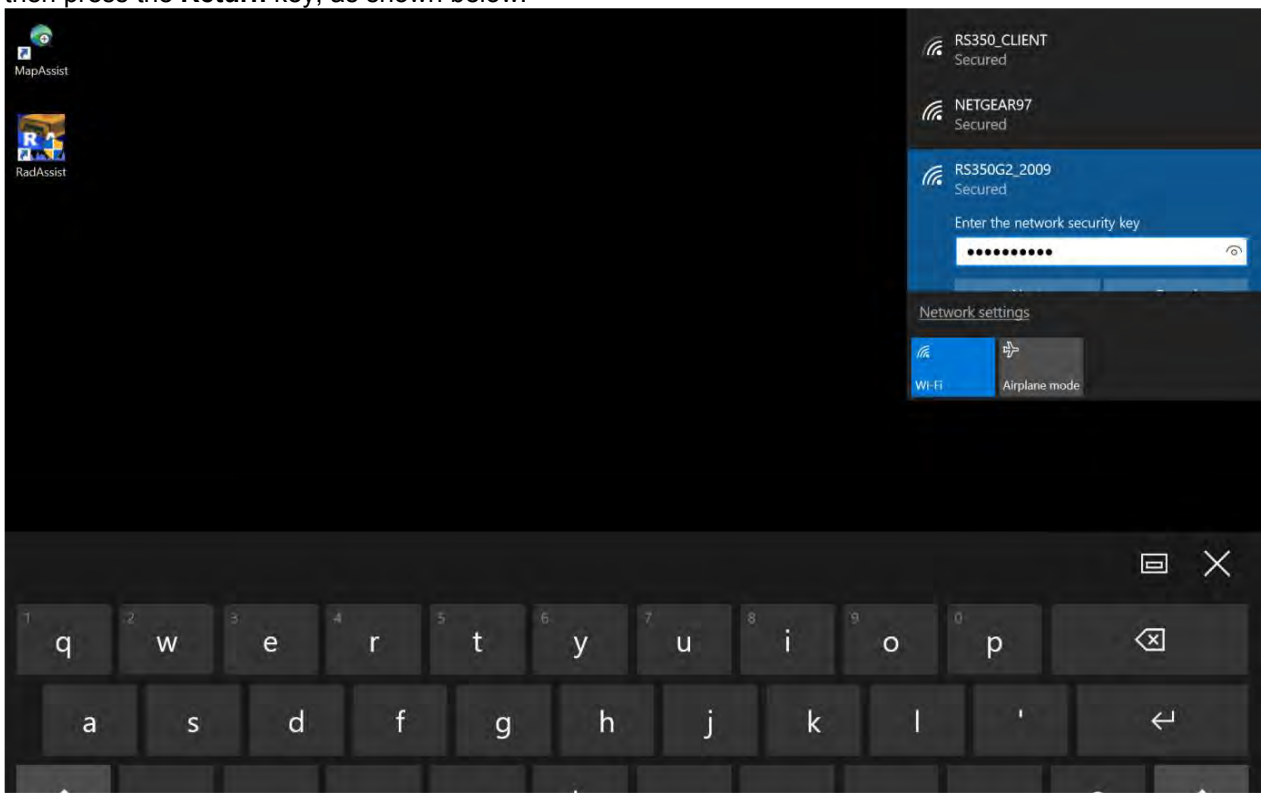


3. To ensure instant connection between the **tablet** and the **RS-350 Backpack** at each startup, check the "**Connect automatically**" checkbox before pressing the **Connect** button as shown above.

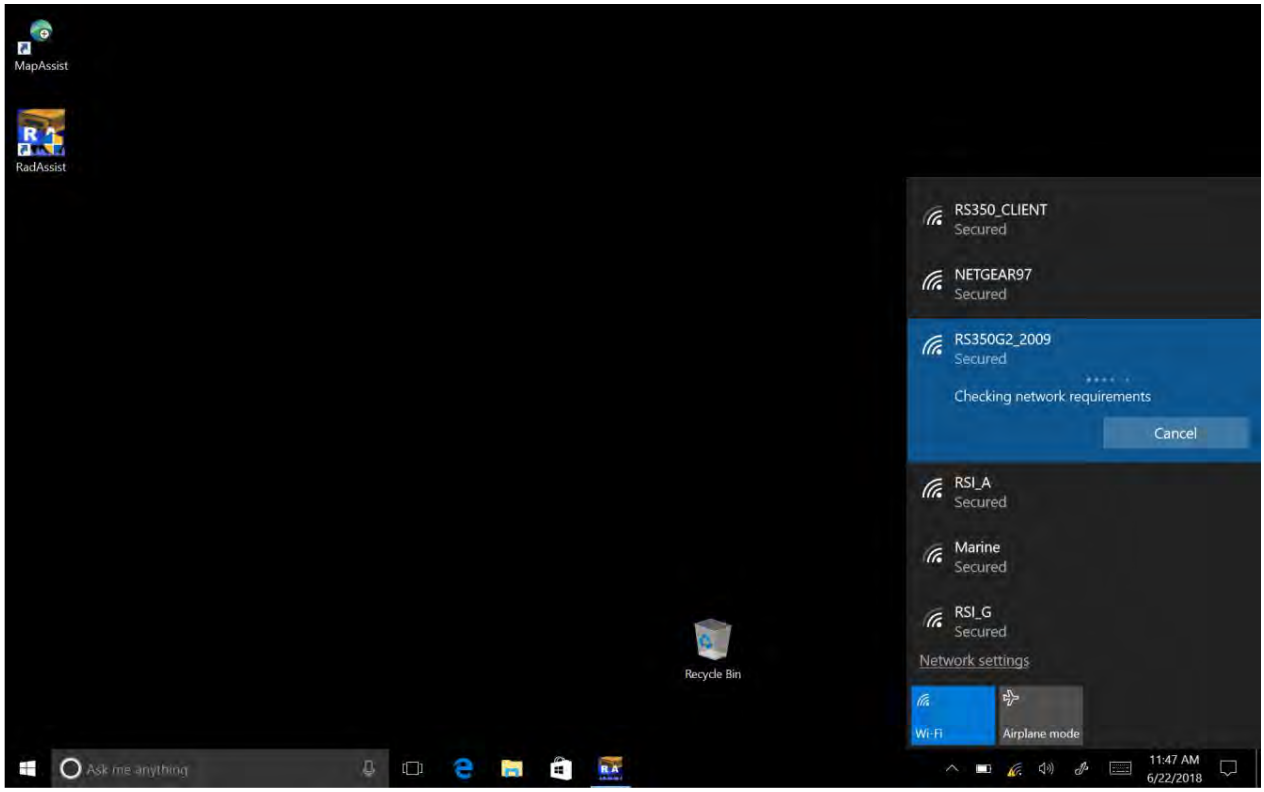
4. A data field displays. Press the **"Connect using a security key instead"** link as shown below.



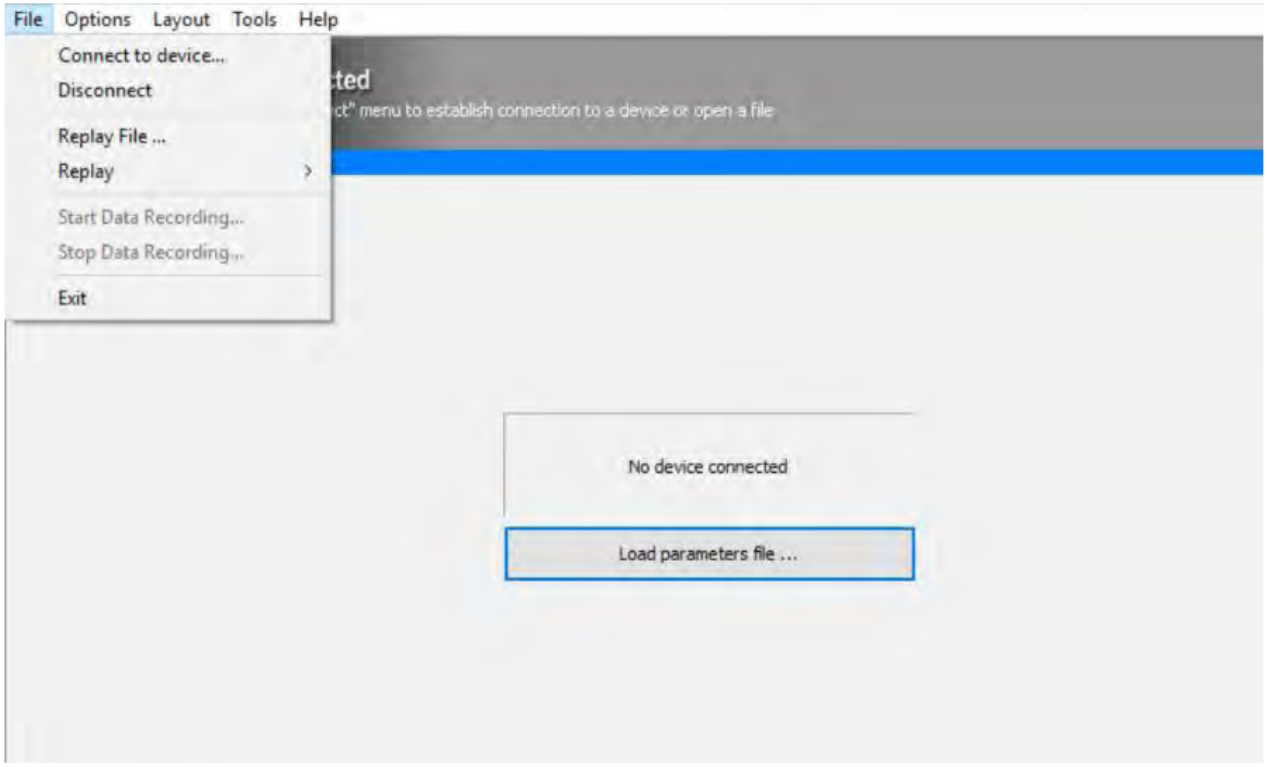
5. Enter in the supplied **Network Security Key** into the data field using the on-screen touch keyboard and then press the **Return** key, as shown below.



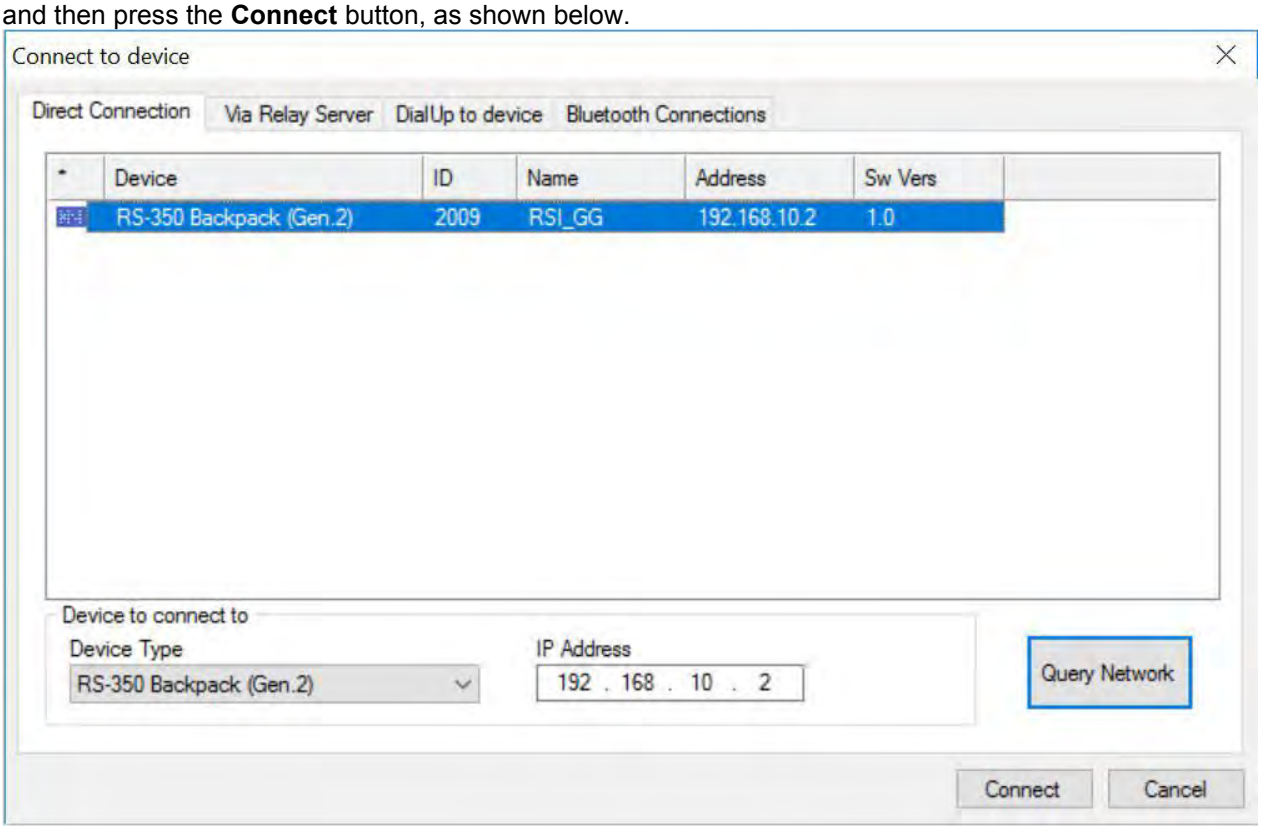
6. Wait for the Wi-Fi Network to fully connect and then double tap the RadAssist desktop icon to load the RadAssist software.



When the **RadAssist Software** opens, go to the **File Menu** and select "**Connect to device**".

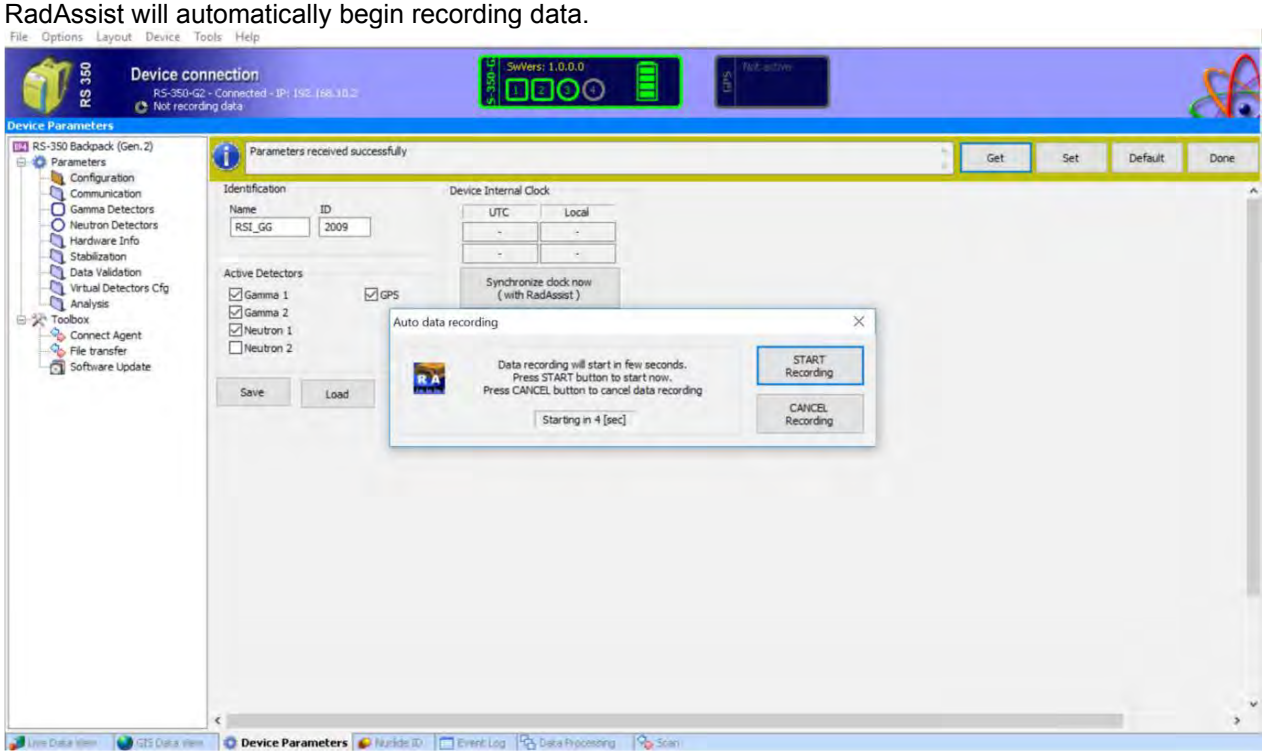


8. The **"Connect to device"** window opens with the **Direct Connection** tab selected by default. This tab will automatically search for any system's connected over the shared **Wi-Fi Hotspot Network**. Click the **Query Network** button if this does not happen. Select the required RS-350 Backpack System from the list and then press the **Connect** button, as shown below.



NOTE: The ID# for the required RS-350 Backpack System will match the last four digits of the Wi-Fi Network Hotspot Name, i.e. **ID# 2009** matches up with **Network Hotspot RS350G2_2009**.

9. The device connects as shown below. A string of three audible messages will be heard by the User to indicate system connection: **Connecting**, **Connected**, and **System Ready**. The **"Auto data recording"** window opens with the option to **START Recording** or to **CANCEL Recording**. If the timer runs out, RadAssist will automatically begin recording data.



NOTE: Any future use of RadAssist past the first-time connection, RadAssist will load with the option to automatically connect to the last connected device. The user can press the **Connect** button to instantly connect to the last connected device or they can press the **Cancel** button to stop the automatic connection so that they may connect to another device. If the **Auto-Connect** timer runs out, RadAssist will automatically connect to the last connected device.

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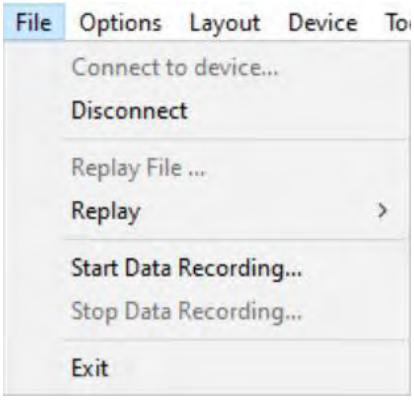
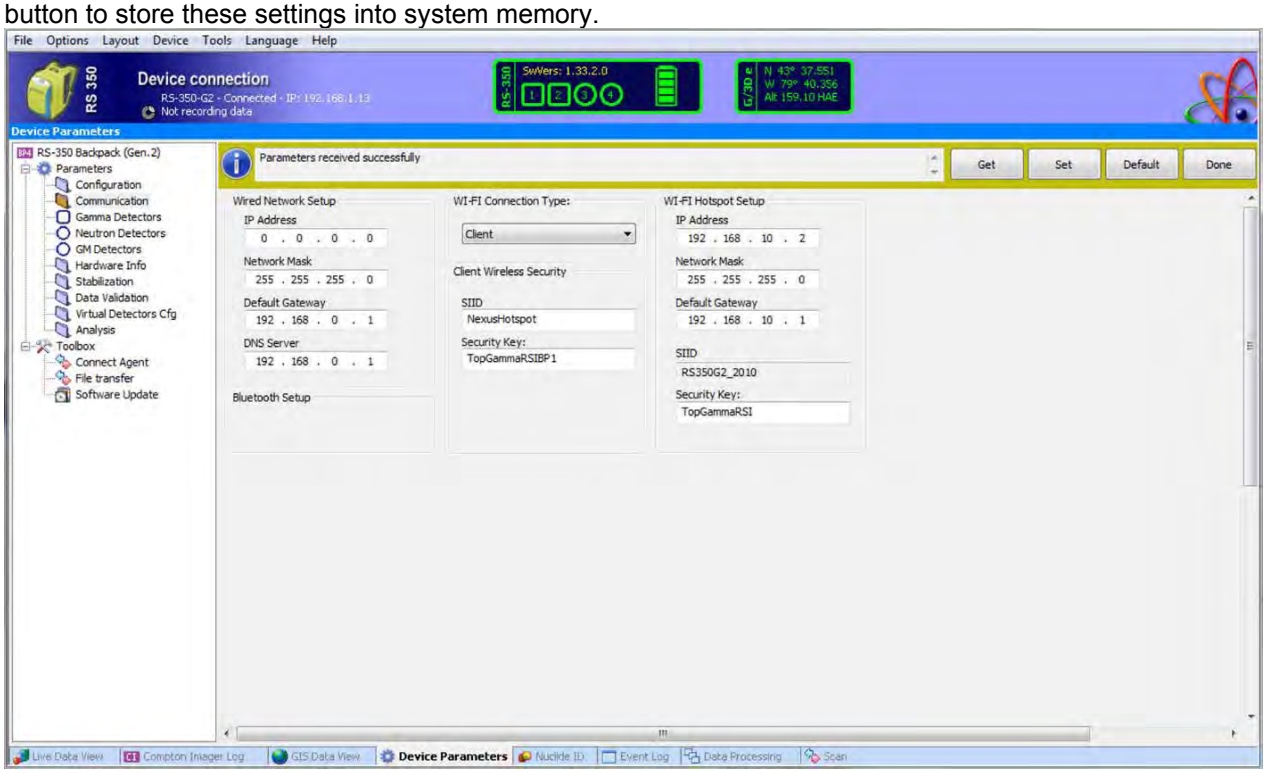
To exit the RadAssist Software:

From the **File Menu**, select "**Disconnect**" and then "**Exit**" to terminate the **RadAssist Software**.



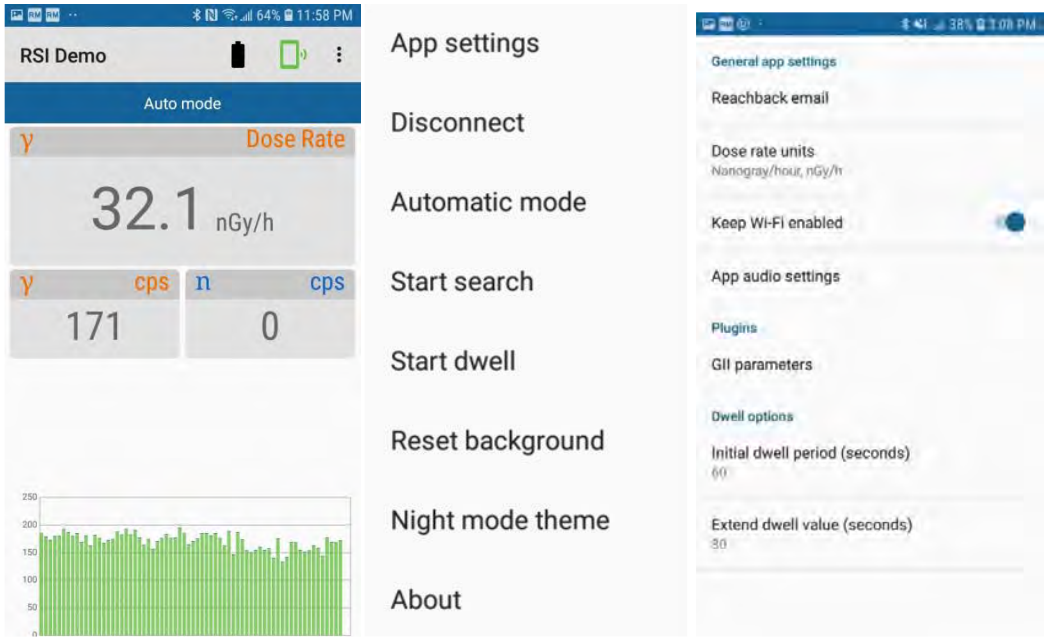
C.3 Enable RS-350 Wi-Fi

1. Start the **RadAssist Software** and connect to the required system, “**File**” □ “**Connect to device**”.
2. Once connected, select the **Device Parameters** tab from the bottom of the Live Data View screen.
3. The **Device Parameters** screen opens. From the left-side **Parameters** menu, select **Communication**”.
4. The **Communication** screen opens. Click the **Get** button as shown below.
5. Once the **Communication Parameters** have been retrieved by the System, open the **Wi-Fi Connection Type** drop-down menu and select “**Client**” as shown in the Figure below and click the **Set** button to store these settings into system memory.



C.4 RadMobile – Keep Wi-Fi Enabled

To ensure a continuous connection between the RadMobile app and the system, select "**App Settings**" from RadMobile's main menu. The **General app settings** screen opens *(shown to the right)*. Select "**Keep Wi-Fi enabled**".



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APPENDIX Z – WARRANTY

Radiation Solutions Inc. Warranty

RSI BackPack Detector series products are provided with a two (2) year return to factory limited warranty against defects in materials and workmanship from the date the Products are placed at the disposal of the Buyer at the named place of delivery**. The warranty does not cover damage caused by improper use or unauthorized repairs.**

Repairs of defects will be performed by RSI at no charge to the Buyer, subject to the limitations. To request warranty service, the Buyer must call RSI's service coordinator for a return material authorization (RMA) number.

The Buyer is responsible for all the shipping, customs clearance costs and risk of loss of returning the repaired or replaced Products to the Buyer. RSI will own all parts removed from repaired Products or all Products replaced.

RSI's warranty does not include breakage of the crystal for any reason. RSI does warrant the detectors to be complete and fully operational to their published specifications at the time of delivery and to maintain the minimum resolution and performance for a period of one year under normal operating conditions.

Complete details of the "*Standard Terms and Conditions*" may be obtained by contacting RSI.

For more information or to make a warranty claim contact RSI.

Contact Information

Phone: **(905) 890-1111**
Fax: **(905) 890-1964**
Email: **service@radiationsolutions.ca**
sales@radiationsolutions.ca