EGS-T200X

GAMMA SPECTROMETER

TELEMETRY ENABLED

elementz
Engineers Guild Pvt Ltd

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Chapter 1

Overview

1.1 Introduction

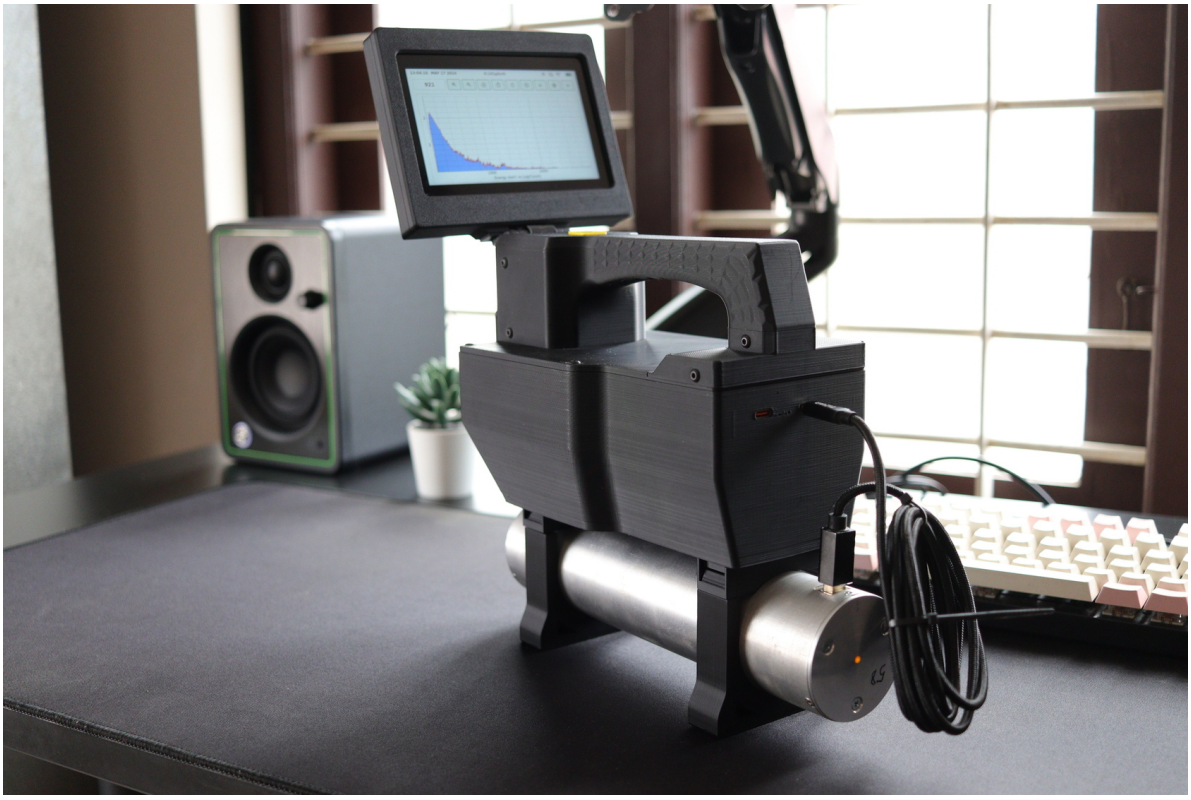

Figure 1.1: EGS-T200

The EGS-T200 Gamma Spectrometer is a portable, high-performance device designed to detect gamma radiation and identify radioactive elements in an area. It incorporates cutting-edge technology, including a NaI(Tl) crystal-based multichannel analyzer, renowned for its nuclear spectrometry capabilities. With its portability and wireless communication capabilities, the EGS-T200 sets a new standard for efficiency, reliability, and safety in radiation detection.

By enabling remote monitoring of radiation levels, it empowers authorities and organizations to respond to potential threats and mitigate risks promptly. Whether it's monitoring radiation exposure in hazardous environments or ensuring compliance with safety regulations, the Gamma Spectrometer is a versatile solution tailored to meet the evolving radiation detection and monitoring needs.

- Portable & Ergonomic Design.
- User-Friendly Interface & Fast Startup.
- Large 5" IPS LCD Articulating Display with 800 * 480px Resolution.
- 0.01 µSv/h to 250 µSv/h Dose Rate.
- Large 20000mAh Battery.
- Features Fast Charging, enabling a 0% to 80% charge in just 5 hours.
- Re-configurable Telemetry Cycle from 10 seconds to 15 minutes.
- Support for RADScope Android App (Optional).
- Auto Backup & Restore Function.

Figure 1.2: EGS-T200 Front

1.2 Technical Specifications

Parameter	Minimum	Maximum	Unit	Remarks
Battery Capacity		20000	mAh	
Battery Life	10	14	h	
Operating Range	-30	60	°C	
Dose Rate Range	0.01	250	uSv/h	
Energy Response	0	3000	KeV	
Total Weight	1660	1680	g	
Dimensions	234*139*213	236*141*215	mm	L*W*H
Charging Current		3000	mA	
Preferred Charger		HVDCP/PD		
Enclosure Material		ABS		

Chapter 2

Hardware Interface

This chapter describes the hardware features of the EGS-T200 Gamma Spectrometer. It highlights the sensor technology, the high-resolution display, the ports, the LED indicators, and charging hardware, all of which contribute to the functionality and ease of use.

2.1 Sensor

Figure 2.1: NaI(Tl) crystal-based sensor

EGS-T200 employs a 1*1 inch NaI(Tl) (Thallium-doped Sodium Iodide) crystal-based sensor. This type of sensor is well-regarded for its good light-emission quality, high density, and high photon yield. The sensor connects to the main device using a USB Type-C connector.

2.2 Ports & Indicators

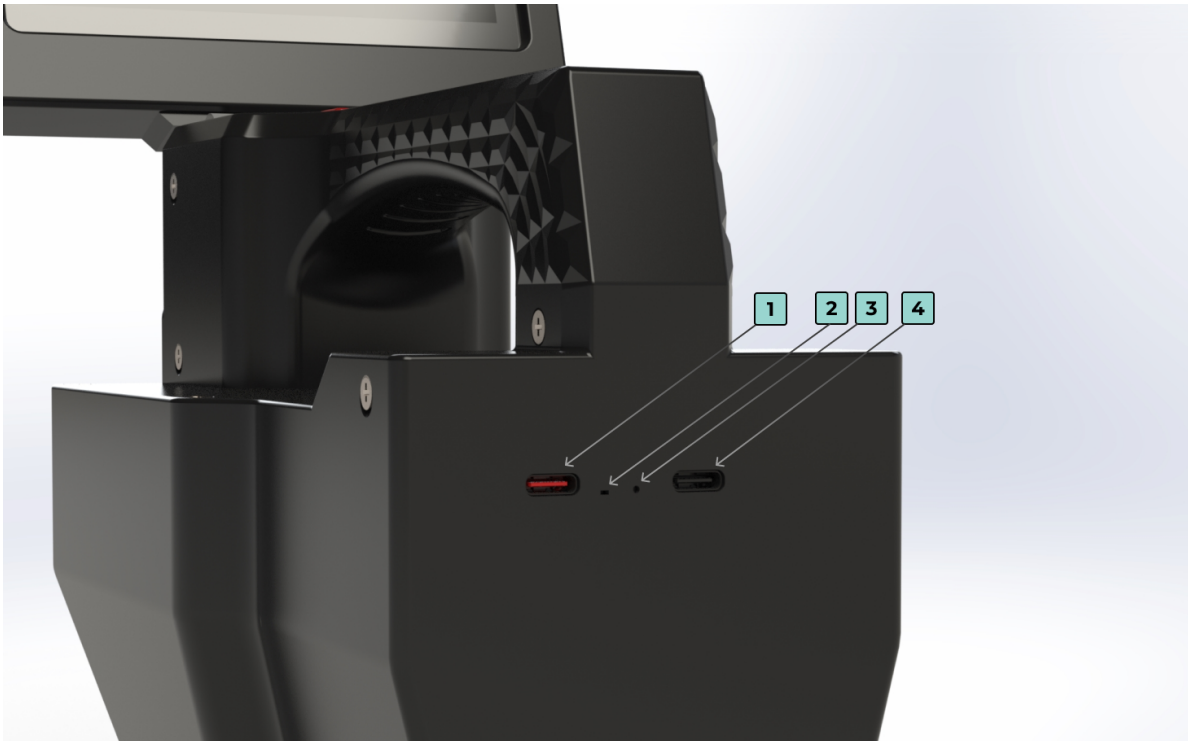

Figure 2.2: EGS-T200 Ports

The EGS-T200 includes two USB Type-C connectors located at the front of the device, a power button, and two LED indicators.

1. The connector marked **1** in the Image 2.2 is the **Charging Connector**. The color of port is red, indicating that the connector is dedicated for charging.

2. The LED marked **2** in the Image 2.2 is the **Charging LED**.

Charging Status	**LED Color**	**LED Pattern**
Charging	Red	ON
Not Charging	-	OFF
Charging Fault	Red	Blink

3. The Connector marked **3** in the Image 2.2 is the **Reset Button**.

4. The Connector marked **4** in the Image 2.2 is the **Sensor Connector**. This port is dedicated to connect the sensor to the device.

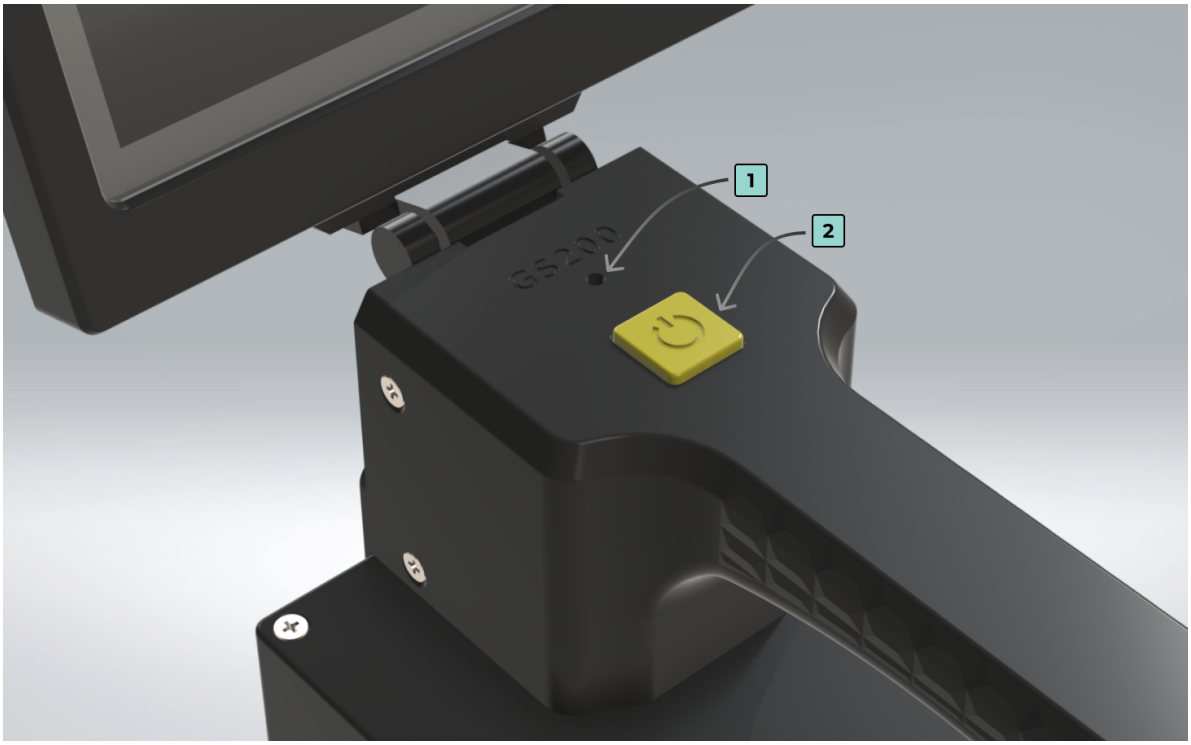

Figure 2.3: EGS-T200 Button & Indicator

1. The LED marked **1** in the Image 2.3 is the **Device Status Indicator**.

Device Status	**LED Color**	**LED Pattern**
Device ON	Green	Pulse
Turning OFF	Green	Fast Blink
Battery Low	Red	Pulse
Fuel Gauge Error	Cyan	Fast Blink
IO Error	Magenta	Fast Blink
Charging Fault	Yellow	Fast Blink
Unknown Error	Red	Fast Blink

2. The Button marked **2** in the Image 2.3 is the **Power Button**. The power button, which requires a long press to activate or deactivate the system, is strategically placed for easy access.

Note: The device does include haptic feedback, and can be noticed on the handle during operation.

2.3 Display

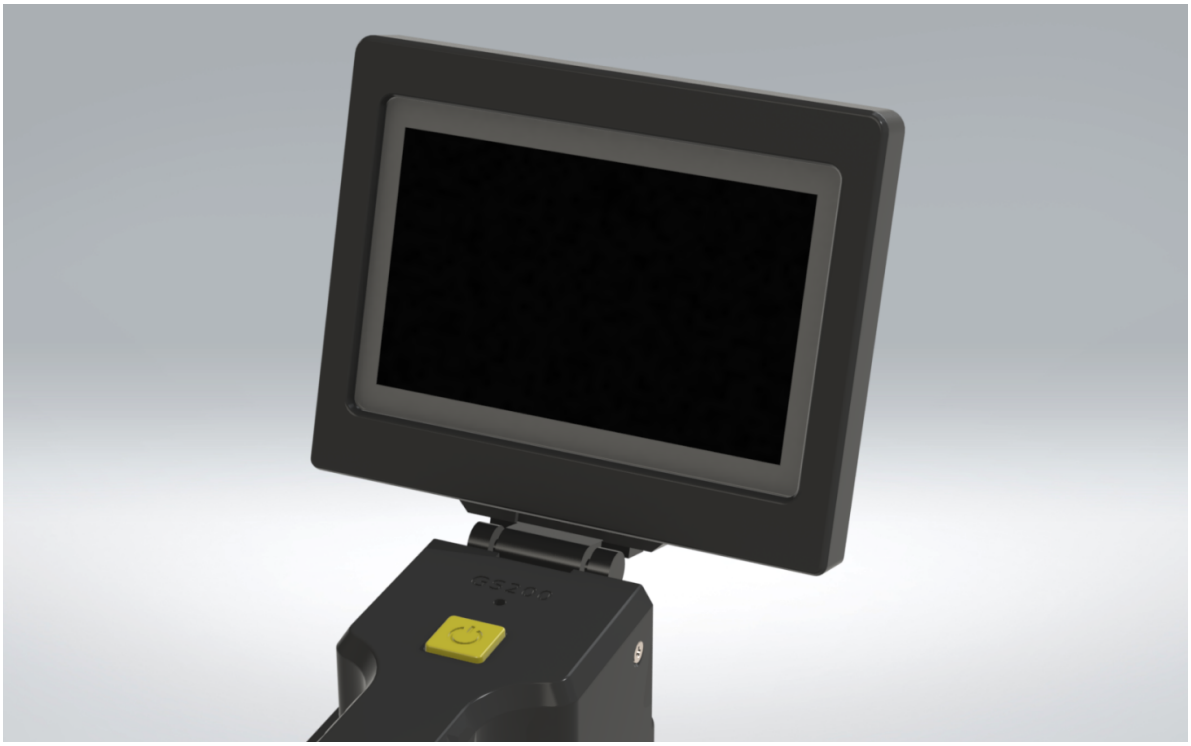

Figure 2.4: EGS-T200 Display

EGS-T200 features a 5-inch display with a resolution of 800 * 480 pixels, providing detailed visualization of data. The interface is designed to be intuitive, offering clear navigation that allows users to easily interact with the system and access its functionalities. This user-friendly design aims to minimize the learning curve and enhance user experience, making the device accessible to both novices and experienced professionals.

2.4 Charging Hardware

The use of the bundled fast charger is recommended for the best user experience, even though any charger having a USB interface is acceptable. The device is capable to communicating with the charger in order to get up to 12V.

A PD/HVDCP charger capable of delivering at least 12V at 2.5A is necessary for the device to power the hardware as well the charge the battery. If this is not the case, the battery may not be charged at an optimal rate. The charging current and voltage can easily be monitored from the **Device Settings**.

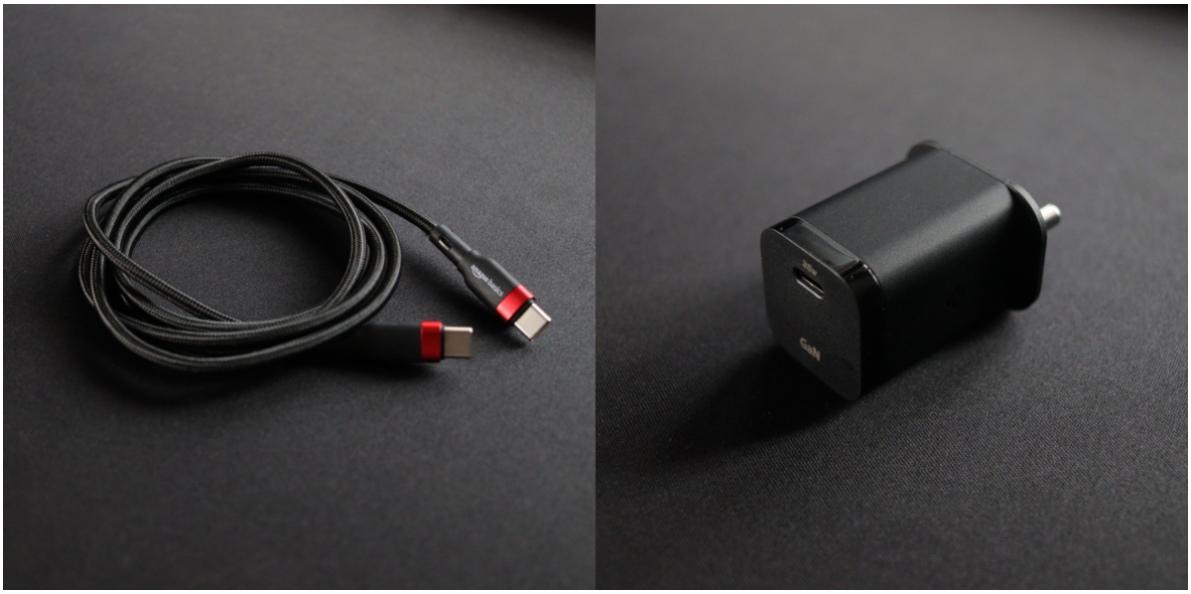

Figure 2.5: Bundled PD Charger

The device employs several power path specific circuitry to make the device usable even while fast charging. The core components of the circuitry are mentioned in the following sections.

2.4.1 Dynamic Power Path Management (DPPM)

The device incorporates **DPPM** to simultaneously control power paths to the system and the battery. This would mean that the device will be powered by the charger, while the excess power that the charger is capable of delivering, is used to charge the battery. If the device is turned off, only the battery will be charged since the system will only consume negligible amount of power.

2.4.2 Supplement Mode

If a charger below 5W (5V-1A) is used while the device is turned ON, the charger may not be capable of powering the system independently. In this case, the battery will supplement power to the system along with the charger. This means that the charger will not charge the battery, but will reduce the battery discharging rate. So it is recommended to turn OFF the device if an after market charger with low output power is used.

2.4.3 Battery Charging Management

The device charges Li-Ion battery with up to 3A charge current. The 11-mΩ BATFET improves charging efficiency and minimize the voltage drop during discharging.

2.5 Battery Protection

The device has protection for the following conditions,

- Over Voltage Protection.
- Under Voltage Protection.
- Over Current Protection (Charging & Discharging).
- Short Circuit Protection.
- Over Temperature Protection.

2.5.1 Thermal Protection

The device continuously monitors NTC on the battery, and disables charging if the battery temperature is below 0°C or above 54°C. The device also monitors internal junction temperature to avoid chip overheating and limits the IC surface temperature. The battery temperature can easily be monitored from the **Device Settings**.

Chapter 3

Device Operation

This chapter outlines procedures related to device operations. It covers actions such as powering the device on and off, power reset, implementing a delayed pause feature, enabling the energy axis, adjusting the Y-axis scale, and establishing WiFi and cloud connections.

3.1 Turning ON Device

The device can be powered ON by the following step.

- **Long Pressing the Power Button:** To turn ON the device, press and hold the **Power Button** until a vibration is felt and the **Device Status Indicator** starts pulsing. This action will initiate the boot-up process and the device will take up to 40 seconds to be fully functional.

3.2 Turning OFF Device

The device can be turned OFF by two methods.

- **Using the System Settings:** Navigate to the **System Settings** and select the **Power Off** option. Executing this option will initiate a controlled shutdown process, ensuring all applications and processes are properly closed before the device powers down completely. This method provides a safe and orderly way to shut down the entire system.
- **Long Pressing the Power Button:** To turn OFF the device, press and hold the **Power Button** until a vibration is felt and the **Device Status Indicator** starts blinking fast. This will trigger the shutdown sequence, and the device will turn off. This method should only be preferred if the user is facing any issue with the display.

3.3 Charging the Device

The device ships with a 35W **PD** (Power Delivery) Charger along with a USB Type C to C Cable. Charge the device by connecting the USB C to C Cable to the charging port and a red LED near the charging port will turn on when the device starts charging (Image 2.2). The LED will turn off once the device is fully charged.

3.4 Power Reset

In case of any malfunction, there are two ways to restart the whole device. They are mentioned in the following sections.

3.4.1 Controlled Restart

- Turn OFF the device by long pressing the **Power Button** until a vibration is felt and **Device Status Indicator** starts blinking.
- The device will turn OFF after a few seconds, a second vibration will be felt, also the **Device Status Indicator** will turn OFF completely.
- Turn ON the device by long pressing the **Power Button** until a vibration is felt and **Device Status Indicator** starts blinking.

3.4.2 Hardware Power Reset

- Using a Pin, long press on the **Reset Button** (Image 2.2) until the device restarts. The battery will be reattached, which will reset the whole system.
- The device will restart, a vibration will be felt on the handle and the **Device Status Indicator** will start pulsing.

3.5 Auto Backup & Restore

The device can be used without connecting to the internet. The logs are automatically saved within the device. The user can reconnect the device to the network later, which will automatically backup the logs to the server. The web app will show the dose rate and spectrum corresponding to each location on the map.

3.6 Delayed Pause

Delayed Pause Interval (DPI) represents the time interval after which the spectrum will be paused. The spectrum will be paused when the **Acquisition Time (AT)** is reached.

1. Set the **Acquisition Time (AT)** from Sensor Settings
2. Set the **Delayed Pause Interval (DPI)** from Graph Settings. This should be lower than that of AT.

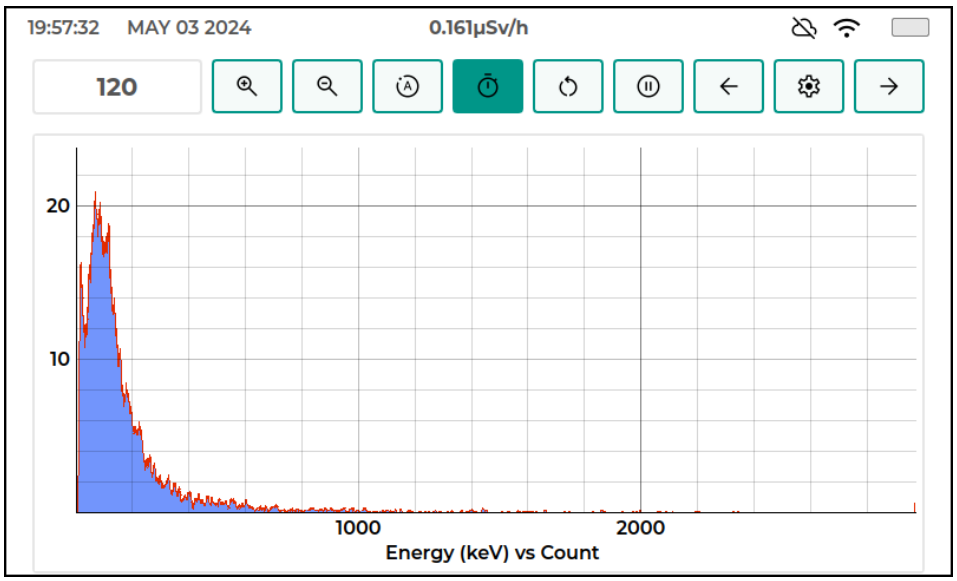

Figure 3.1: Setting Delayed Pause Interval

3. Enable DPI by pressing the icon in the Image 3.1. (Note: If the icon turns to yellow, then AT has gone past DPI. Reset the spectrum & try again.)
4. Once the configured DPI is reached, the graph will be paused for further evaluation.
5. After evaluation, disable DPI by pressing the icon in the Image 3.1.

3.7 Enable Energy Axis

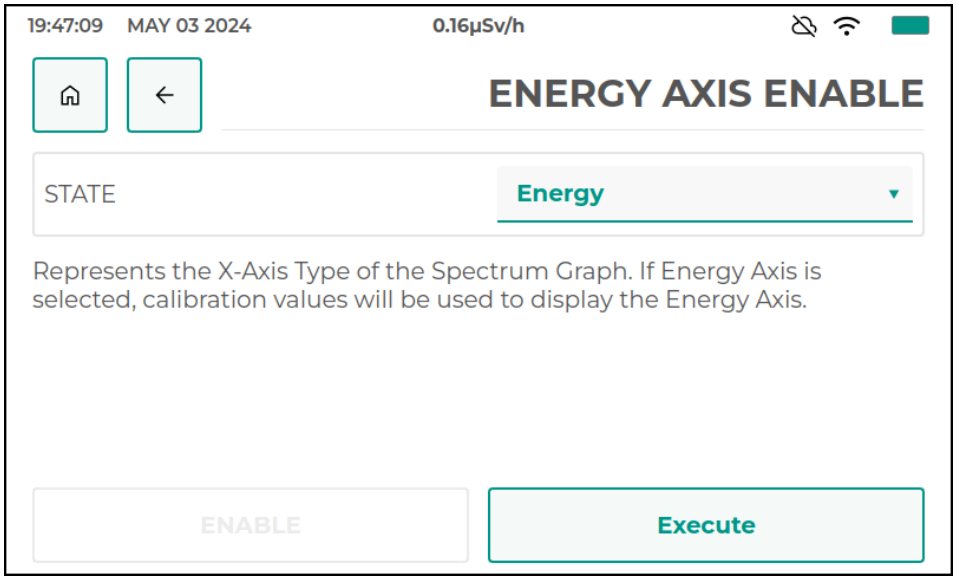

Figure 3.2: UI - Enabling Energy Axis

The graph settings for the energy enable axis option include two distinct states: ADC Channels and Energy. This feature is crucial for configuring how data is represented on the X-axis of the graph.

When the **Energy** state is chosen,

- The X-axis shows Energy Bins instead of raw ADC Channels.
- The X-axis will display Energy Bins, allowing for a direct interpretation of the spectral data in terms of energy.

When **ADC Channel** state is selected,

- The X-axis of the graph displays the raw data in terms of ADC channels.

3.8 Y-axis Scale

The Y-axis scale in graph settings can be adjusted to three different types of scaling: Linear, Logarithmic, and Square Root.

1. **Linear Scaling** displays equal distances on the Y-axis corresponding to equal differences in values.
2. **Logarithmic Scaling** uses a logarithmic function to represent values, which is each equal distance on the Y-axis represents an increase by a factor of the base of the logarithm.

3. **Square Root Scaling** uses each point on the Y-axis to represent the square root of the value.

Note: Logarithmic Scaling may have to be chosen to visualize weak sources. For example, to see the peak at 2614keV for Monazite, graph rendered in Logarithmic Scale will be much easier to analyze.

3.9 Connecting Device to the Network

3.9.1 Connecting to a Mobile Hotspot

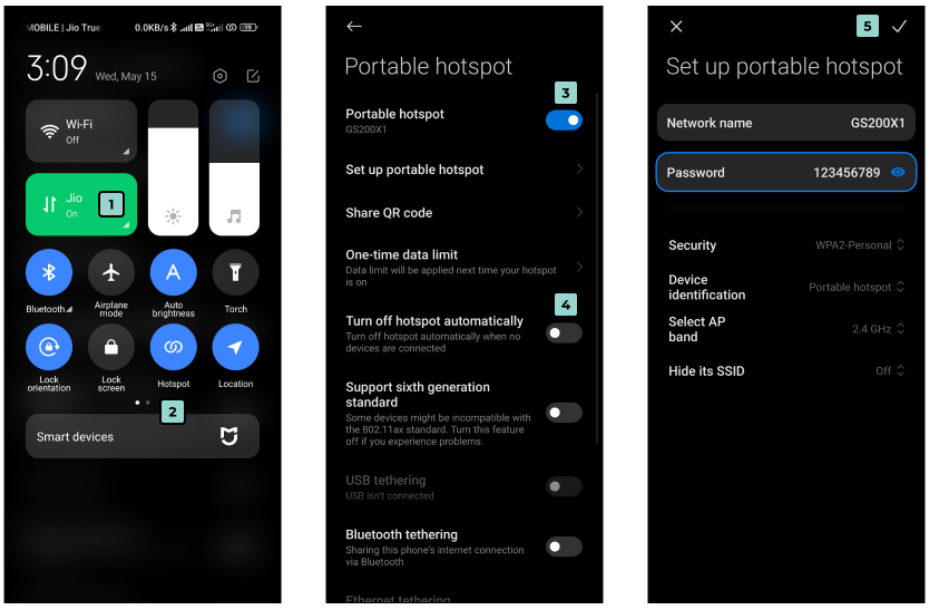

Figure 3.3: Mobile Hotspot Connection

For setting up the hotspot in the mobile

1. Turn on Mobile Data.
2. Enable Hotspot.
3. Mobile's hotspot name can be visible on long pressing the hotspot.
4. Set Hotspot Name and Password.

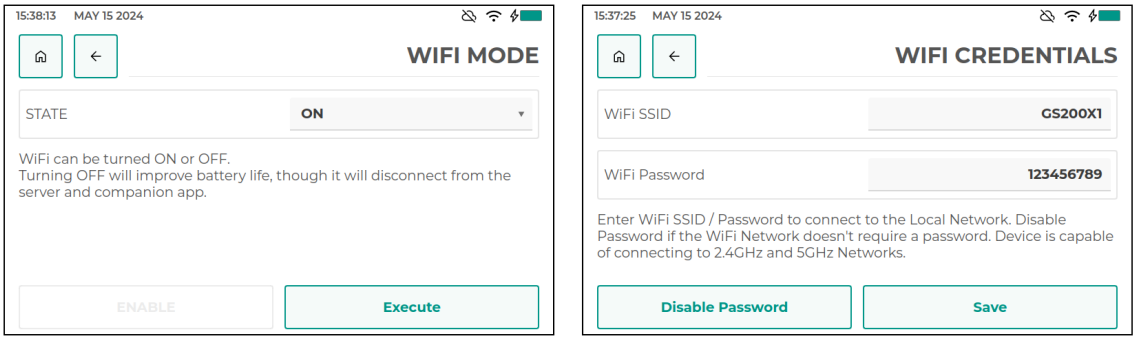

Figure 3.4: Connecting to WiFi

After setting up the hotspot, the device's WiFi can be connected to the mobile's hotspot by

1. Turn on WiFi on the device.
2. Enter the WiFi SSID, and Password of the hotspot user configured earlier to establish the connection.

3.9.2 Connecting to a Local WiFi Network

For connecting the device's WIFI to the local network

1. Turn on Device WiFi.
2. Enter the WiFi SSID and Password of the local network to establish a connection with the local network

3.10 Connecting Device with the Cloud

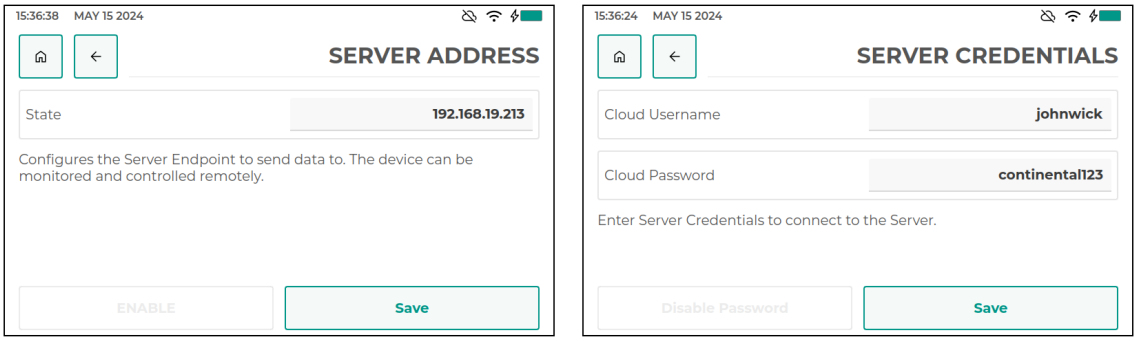

Figure 3.5: Connecting to Server

The device initializes and starts the process of establishing a connection to the cloud server.

- The user should enter the appropriate **Server Address** through the **Network Settings**.
- Enter the **Server Credentials** (Username & Password) through the **Network Settings**.
- The device establishes a secure connection to the configured server using the provided authenticated credentials.

Note: The device will not be pre-configured with the above mentioned settings. Contact Elementz Engineers Guild for Server Address & Credentials.

Chapter 4

User Interface

The user interface of the device is designed to provide a seamless and efficient experience for users, enabling easy navigation and comprehensive functionality across all key features. Below is an in-depth description of the four main pages, which are Home Page, Analysis Page, Spectrum Page, and Settings Page.

4.1 Top Bar

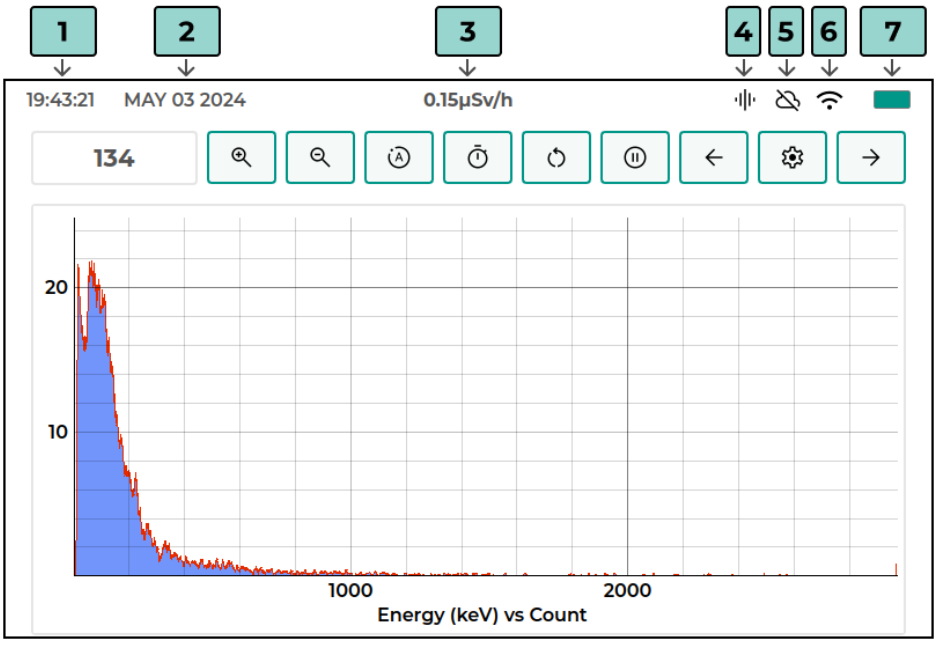

Figure 4.1: Top Bar

The Header from right to left consists of Time, Date, Dose Rate, Acquisition Status, Cloud Connection, WiFi Connection, and Battery Bar.

- The Icon marked **1** in the Image 4.1 shows the **Current Time** in the format of HH:MM:SS.
- The Icon marked **2** in the Image 4.1 displays the **Current Date** in the format MON DD YYYY.
- The Icon marked **3** in the Image 4.1 shows the **Current Dose Rate** in µSv/h.
- The Icon marked **4** in the Image 4.1 shows the **Current Acquisition Status**.
- The Icon marked **5** in the Image 4.1 signifies the status of **Cloud Connectivity**.
- The Icon marked **6** in the Image 4.1 represents the status of **WiFi Connectivity**.
- The Icon marked **7** in the Image 4.1 is the **Battery Bar**, indicating the state of charge.

4.2 Home Page

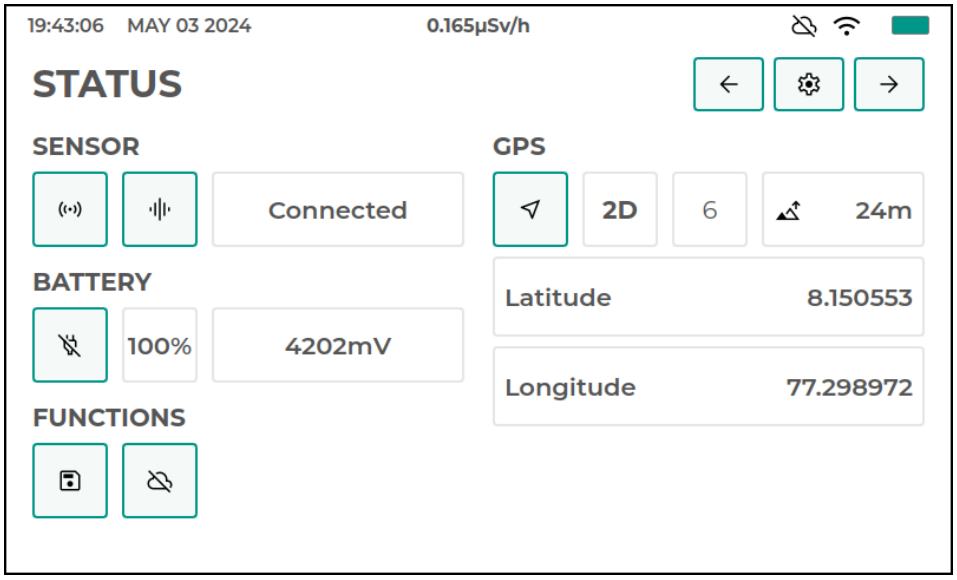

Figure 4.2: UI - Home Page

On the **Home Page**, users are greeted with essential status indicators, including the status of the sensor, battery level, GPS signal strength, and cloud connectivity. These indicators provide users with real-time updates on the device's operational status and connectivity.

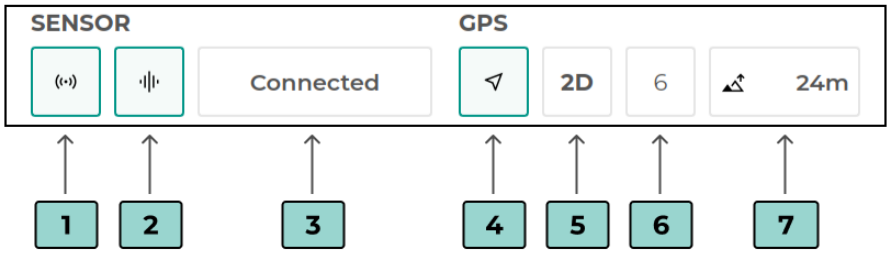

Figure 4.3: Sensor & GPS Status Icons

- The **Sensor Status** Icon marked **1** in the Image 4.3 indicates the current status of the sensor. It shows whether the sensor is physically connected through the USB Interface or not.
- The **Acquisition Status** Icon marked **2** in the Image 4.3 provides information on whether radiation will be measured or not.
- The **Connection Status** field marked **3** in the Image 4.3 displays the connection status of the sensor. If the sensor is connected, the field will show ”Connected”, else ”Disconnected”. If no data is received from the sensor, ”No Data” state will be shown.
- The **GPS Fix** Icon marked **4** in the Image 4.3 indicates the position fix status.
- The **GPS Fix Type** Status Icon marked **5** in the Image 4.3 shows the type of GPS fix that is currently obtained. It will display whether there is a 2D fix (only latitude and longitude) or a 3D fix (latitude, longitude, and altitude).
- The **Satellite Count** Icon marked **6** in the Image 4.3 shows the number of satellites that are currently being tracked.
- The **Altitude** Icon marked **7** in the Image 4.3 displays the altitude or height from sea level.

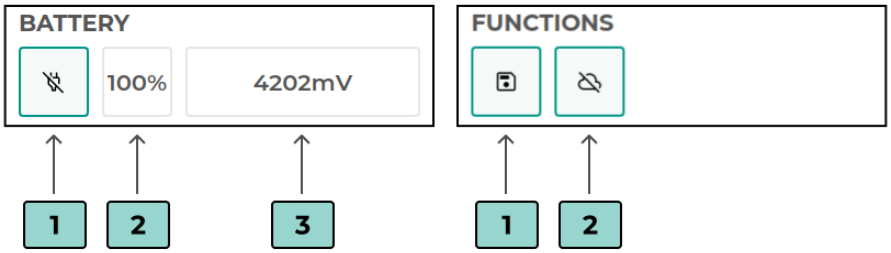

Figure 4.4: Battery & Other Indicators

- The **Charging Status** Icon marked **1** in the Image 4.4 indicates the current charging status.
- The **Battery Percentage** Icon marked **2** in the Image 4.4 displays the remaining battery percentage of the device.
- The **Battery Voltage** Icon marked **3** in the Image 4.4 shows the current battery voltage.
- The **Logging** Icon marked **4** in the Image 4.4 represents whether the device is saving logs locally.
- The **Cloud Connectivity** Icon marked **5** in the Image 4.4 indicates the status of the device's connectivity to the cloud.

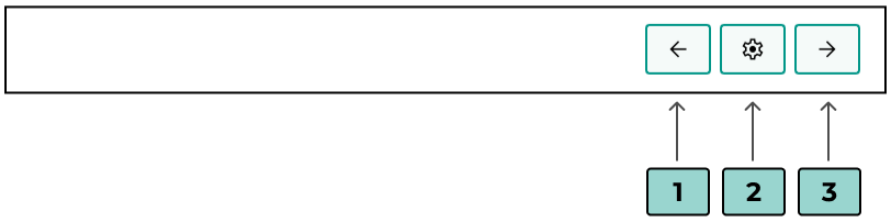

Figure 4.5: Navigation Buttons

Additionally, the home page features a Settings Option, Forward Arrow, and Backward Arrow.

- The Forward Arrow marked **3** in the Image 4.5 navigates users to the next page.
- The Settings Option marked **2** in the Image 4.5 directs users to the **Settings page**, allowing users to customize and configure various parameters according to their specific needs and preferences.
- The Backward Arrow marked **1** in the Image 4.5 navigates users to the previous page.

4.3 Analysis Page

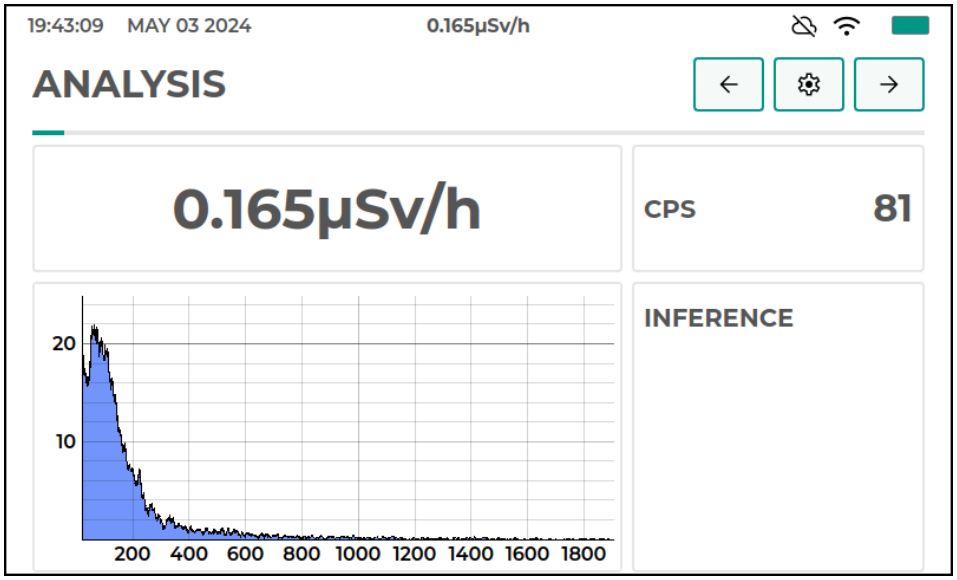

Figure 4.6: UI - Analysis Page

On this page, users can view important data such as radiation levels measured in counts per second (CPS), dose rate, and radiation spectrum on the bottom.

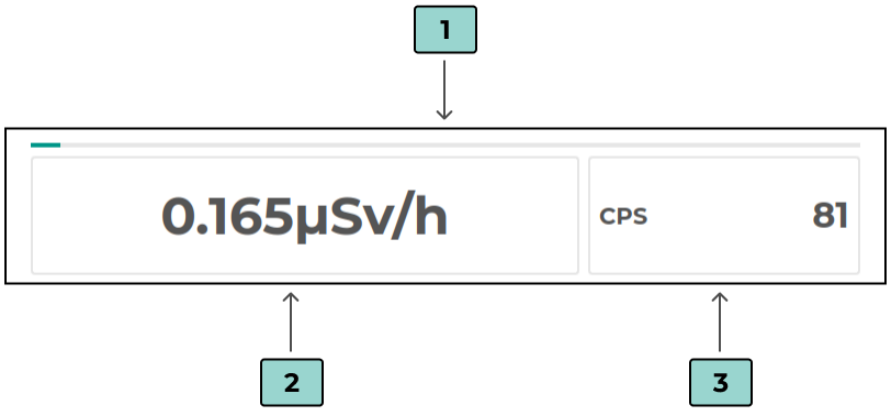

Figure 4.7: Dose Rate & CPS Field

- The progress bar marked **1** in the Image 4.7 indicates the current acquisition time.
- The field marked **2** in the Image 4.7 indicates the dose rate. The dose rate will be displayed with precision to three decimal places.
- The field marked **3** in the Image 4.7 displays the counts per second (CPS).

4.4 Spectrum Page

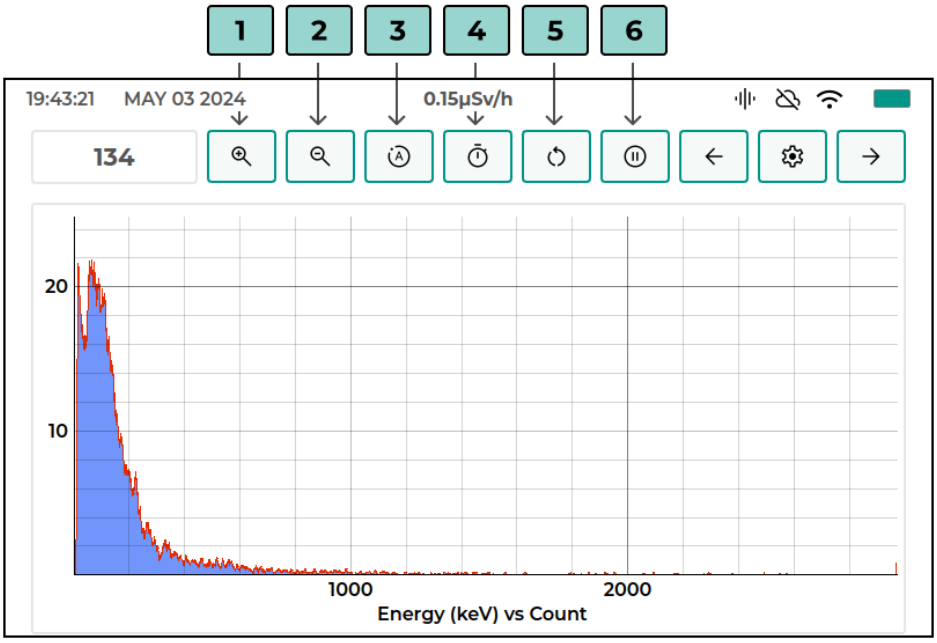

Figure 4.8: UI - Spectrum Page

On this page, users can view radiation levels in each energy bins. At the top of the spectrum, users can find options for:

- Icon marked **1** in the Image 4.8 allows users to zoom in, facilitating a closer examination of particular areas of interest within the spectrum.
- Icon marked **2** in the Image 4.8 enables users to zoom out, providing a broader view of the entire spectrum.
- Icon marked **3** in the Image 4.8 is for auto-ranging the spectrum, which automatically adjusts the range of the spectrum to optimize visualization and analysis.
- Icon marked **4** in the Image 4.8 is for setting a timer. Users can specify when the spectrum will automatically pause after a certain amount of time by adjusting **Delayed Pause Interval** within **Graph Settings**.
- Icon marked **5** in the Image 4.8 allows users to reset the spectrum.
- Icon marked **6** in the Image 4.8 enables users to pause the spectrum, facilitating accurate calculation of peaks or analysis of specific features of interest.

4.5 Settings Page

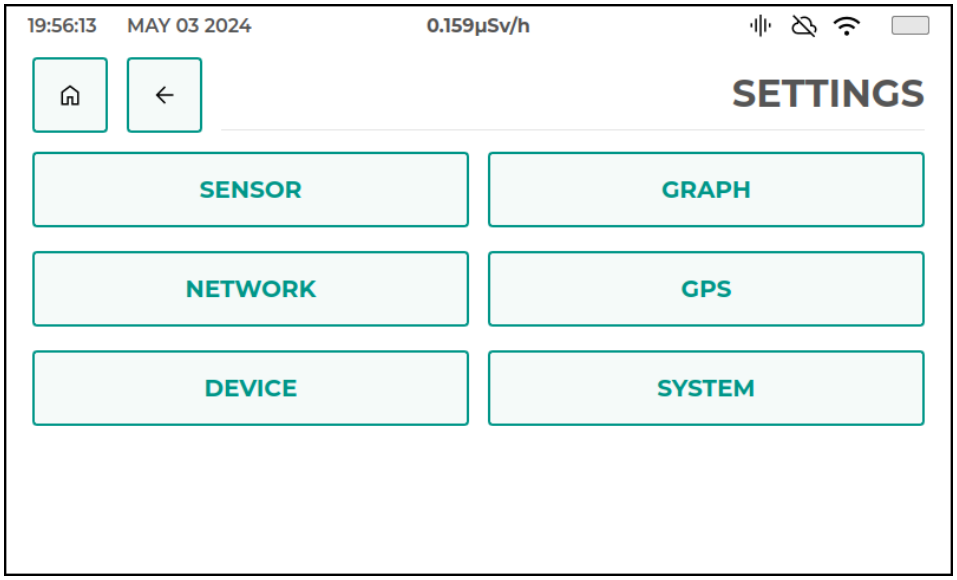

Figure 4.9: UI - Settings Page

This page contains six options, and they are **Sensor**, **Graph**, **Network**, **GPS**, **Device**, and **System**.

4.5.1 Sensor Settings

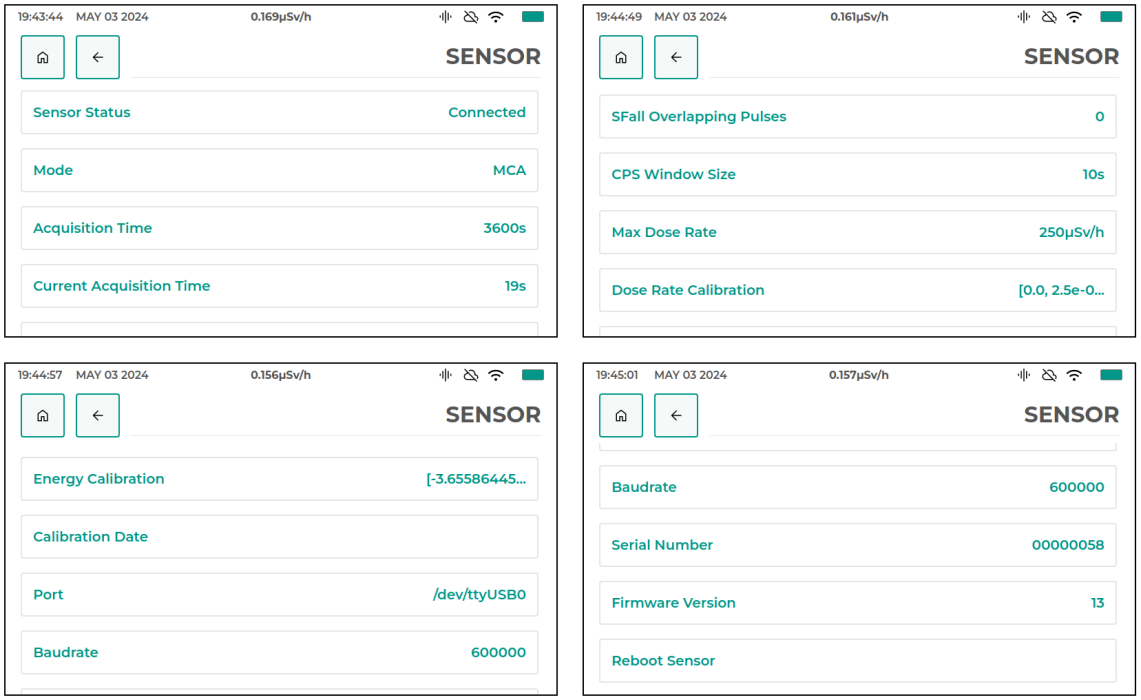

Figure 4.10: UI - Sensor Settings

On this page, different parameters such as Sensor Status, Mode, Acquisition Time, Current Acquisition Time, Invalid Pulses, Sensor CPU Load, Sensor Temperature, Pulse Rise Integration, Pulse Fall Integration, Max Integral Value, High Voltage Adjustment, Baseline Adjustment, Discriminator Level, Discriminator Hysteresis, Discriminator Step, Sampling Frequency, Max Integral Value Compensation, Max Integral Recalculation, Baseline Thermal Compensation, Pileup Compensation, Pileup Compensation Minimum Amplitude, PRise Overlapping Pulses, SRise Overlapping Pulses, PFall Overlapping Pulses, SFall Overlapping Pulses, CPS Window Size, Max Dose Rate, Dose Rate Calibration, Energy Calibration, Calibration Date, Port, Firmware Version, Baud Rate, Serial Number, etc are present.

- **Sensor Status:** This parameter indicates whether the sensor is connected or not.
- **Mode:** This denotes the current operational mode of the sensor.

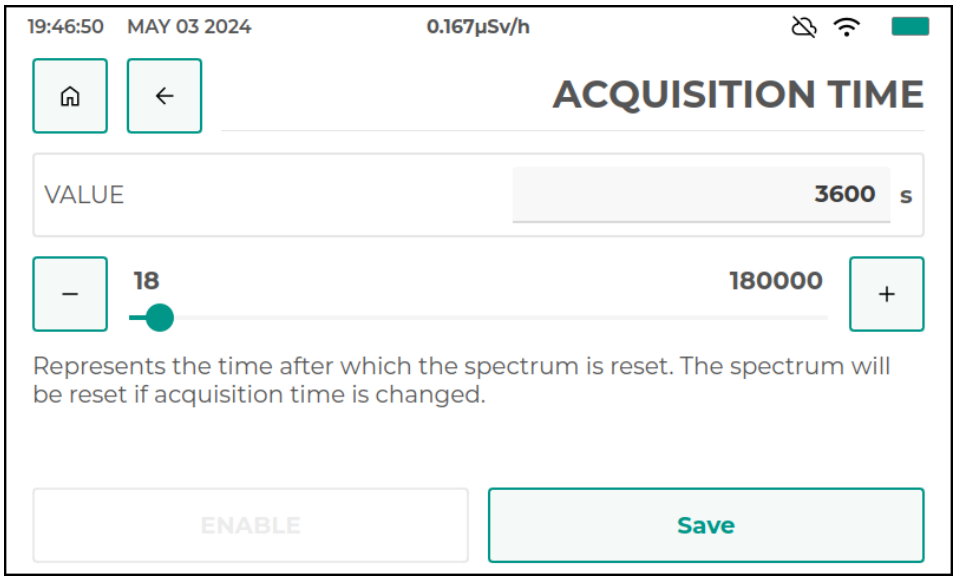

Figure 4.11: Editing Acquisition Time

- **Acquisition Time:** This refers to the time after which the spectrum is reset. the spectrum will reset if the Acquisition Time is changed. The Image 4.11 indicates the way to update the acquisition time
- **Current Acquisition Time:** This represents the elapsed time within the ongoing acquisition interval. It indicates how much time has passed since the last reset of the data spectrum, which is governed by the Acquisition Time parameter.
- **Invalid Pulses:** This refers to the number of pulses that the sensor has identified as invalid.
- **Sensor CPU Load:** This indicates the processing load on the sensor's central processing unit (CPU). It helps in understanding how much of the sensor's processing capacity is

being utilized, which is essential for performance monitoring and troubleshooting.

- **Sensor Temperature:** This indicates the current temperature of the sensor.
- **CPS Window Size:** This defines the window size for averaging pulses per second (CPS). This helps in sudden variations between successive measurements.
- **Max Dose Rate:** This parameter indicates the maximum dose rate the sensor can measure.
- **Dose Rate Calibration:** This setting ensures that the sensor's dose rate measurements are accurate, involving calibration against known sources.

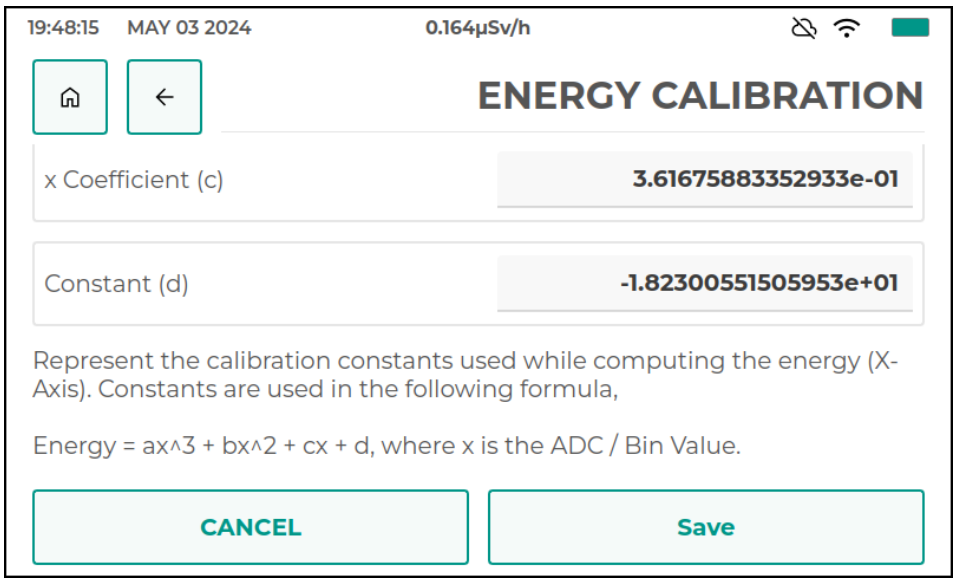

Figure 4.12: Updating Energy Calibration

- **Energy Calibration:** This represents the calibration constants used while computing the energy(X-axis). Constants are used in the following formula.

$$Energy = ax^3 + bx^2 + cx + d$$

- **Calibration Date:** This records the date of the last calibration.
- **Port:** This parameter specifies the communication port used by the sensor to interface with the device.
- **Firmware Version:** This indicates the version of the firmware currently running on the sensor.
- **Baud Rate:** This parameter specifies the data transmission rate between the sensor and the device.

4.5.2 Graph Settings

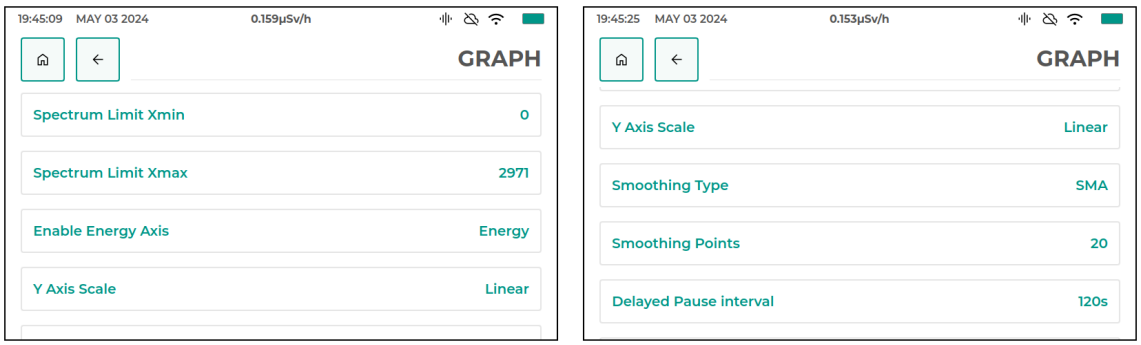

Figure 4.13: UI - Graph Settings

- **Spectrum Limit Xmin:** It is used to limit the X-axis minimum of the Spectrum Graph.
- **Spectrum Limit Xmax:** It is used to limit the X-Axis maximum of the Spectrum Graph.
- **Enable Energy Axis:** This feature represents the X-axis type of the spectrum graph. If the Energy axis is selected, **Energy Calibration** in **Sensor Settings** will be used to compute the Energy axis.
- **Y-axis scale:** Y-axis scale can be adjusted to linear, logarithmic, or square root scaling.
- **Smoothing Type:** The smoothing type can be selected in order to generate a smoother representation of the spectrum data.
- **Smoothing Points:** It represents the number of points to be considered while smoothing the spectrum graph.
- **Delayed Pause Interval:** It represents the time interval after which the spectrum will be paused. The spectrum will be paused if the acquisition time is reached.

4.5.3 Network Settings

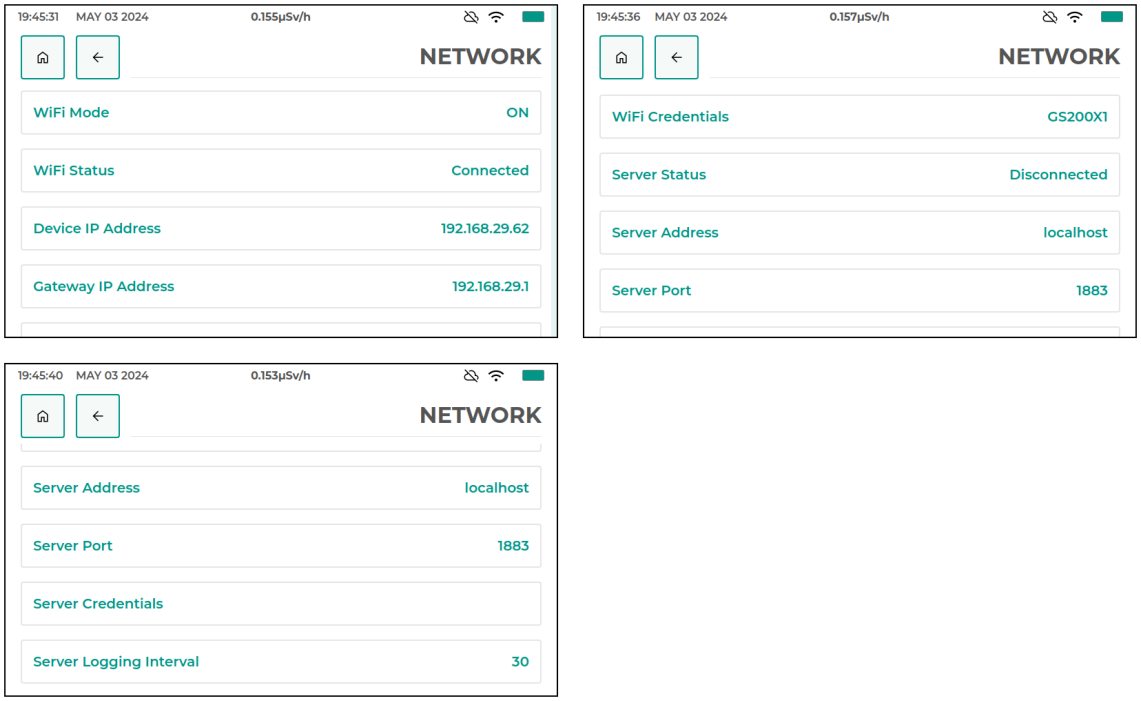

Figure 4.14: UI - Network Settings

This page includes settings for the WiFi Mode, WiFi Status, Device IP Address, Gateway IP Address, WiFi Credentials, Server Status, Server Address, Server Port, Server Credentials, and Server Logging Interval.

- **WiFi Mode:** Specifies whether the WiFi connection is ON or OFF.
- **WiFi Status:** Indicates the current status of the WiFi connection, showing whether it's connected or disconnected.
- **Device IP Address:** Displays the IP address assigned to the Gamma Spectrometer device on the local network.
- **Gateway IP Address:** Shows the IP address of the gateway or router used for connecting the device to the internet.
- **WiFi Credentials:** Allows users to enter or modify the credentials (SSID and Password) required for connecting to a WiFi network.
- **Server Status:** Specifies Connection status to the server, showing whether it's connected or disconnected.
- **Server Address:** Allows users to input server endpoint for enabling cloud connectivity.

- **Server Port:** Specifies the port number used for communication with the server.
- **Server Credentials:** Allows users to input authentication credentials (username and password) required for accessing the server.
- **Server Logging Interval:** Sets the interval at which data is logged and transmitted to the server, controlling the frequency of data updates.

4.5.4 GPS Settings

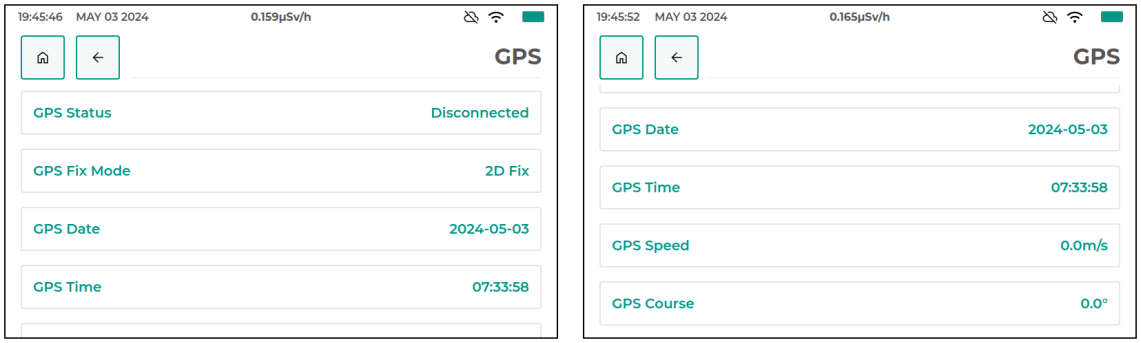

Figure 4.15: UI - GPS Settings

This page contains GPS Status, GPS Fix mode, GPS date, Time, Speed, Course, Sync RTC

- **GPS Status:** Indicates the GPS status, whether GPS is connected or not.
- **GPS Fix Mode:** Represents whether GPS has a valid location or not.
- **GPS Date:** Displays the current date obtained from the GPS receiver in the format YYYY-MM-DD ensuring accurate time-stamping of data.
- **GPS Time:** Shows the current time obtained from the GPS receiver in the format of HH:MM:SS.
- **GPS Speed:** Provides information about the device's current speed based on GPS data, useful for tracking movement and velocity. Speed position accuracy of 0.1m/s.
- **GPS Course:** Indicates the direction or bearing of movement derived from GPS data, providing orientation information.

4.5.5 Device Settings

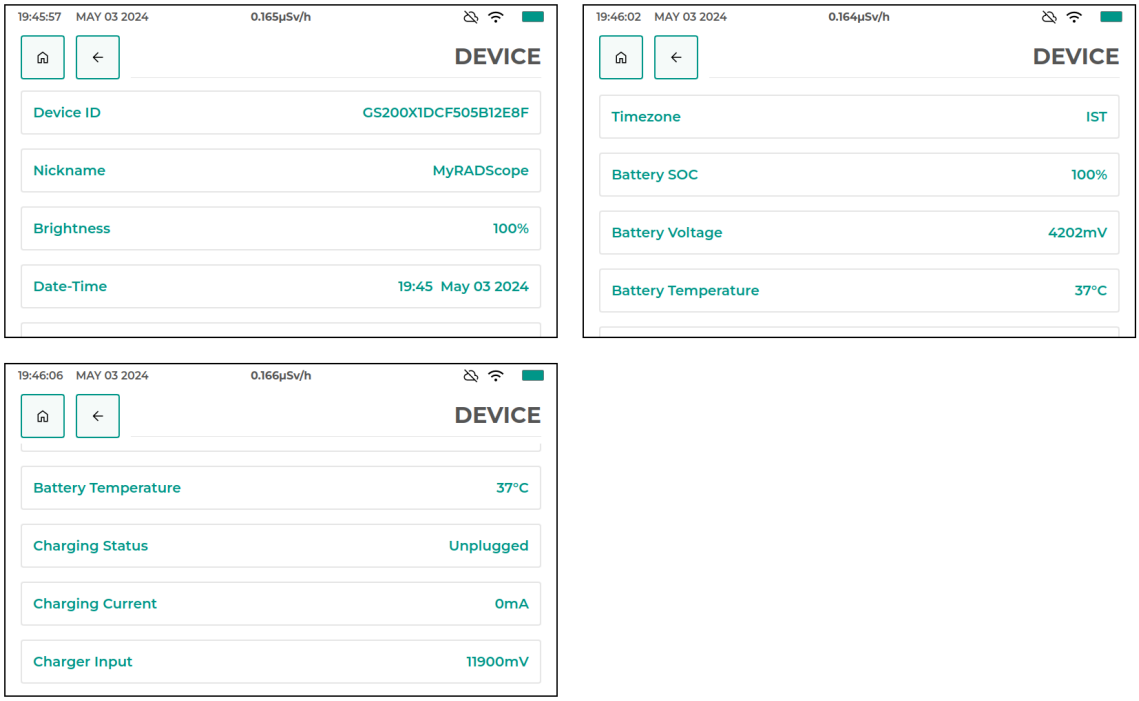

Figure 4.16: UI - Device Settings

This page consists of Device ID, Nickname, Brightness, Date-Time, Timezone, Battery SOC, Battery Voltage, Battery Temperature, Charging Status, Charging current, and Charger input.

- **Device ID:** Displays a unique identifier assigned to the GS200 device, facilitating device management and identification.

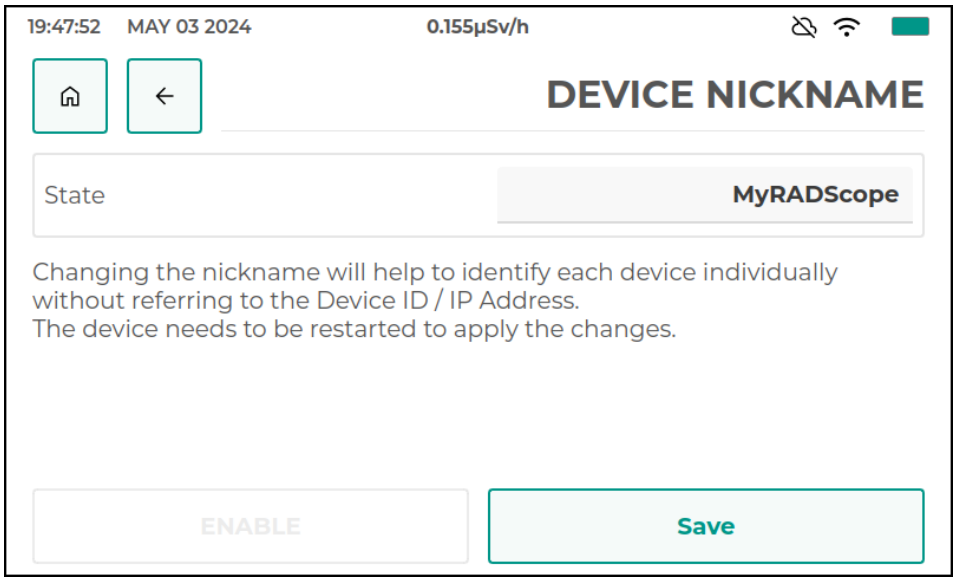

Figure 4.17: Changing Assigning Nickname

- **Nickname:** Allowing users to Assign a custom name or label to the device for easy recognition and identification within a network or system is shown in the Image 4.17. The device needs to be restarted to apply the changes.
- **Brightness:** Adjusts the brightness level of the device's display.
- **Date-Time:** Displays the current date and time of the device.
- **Timezone:** Allows users to specify the local time zone in which the device operates.
- **Battery SOC:** Indicates the current level of charge remaining in the device's battery.
- **Battery Voltage:** Displays the voltage level of the device's battery.
- **Battery Temperature:** Provides information about the temperature of the device's battery.
- **Charging Status:** Indicates whether the device's battery is currently charging or Unplugged.
- **Charging Current:** Displays the current flow rate during battery charging.
- **Charging Input:** Represents input source voltage.

4.5.6 System Settings

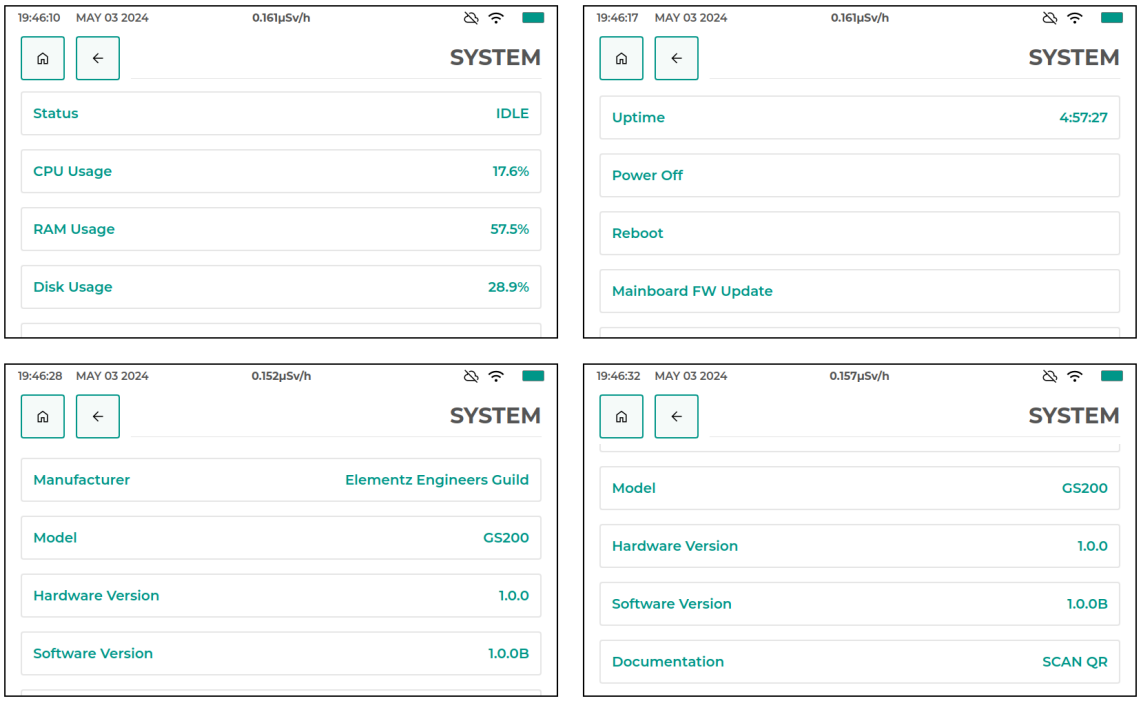

Figure 4.18: UI - System Settings

This page contains System status, CPU usage, RAM usage, Disk usage, Uptime, Power Off, Reboot, Mainboard FW Update, Manufacturer Name, Model, Hardware Version, Software Version, and Documentation.

- **System Status:** The system is in idle state when it is powered ON.
- **CPU Usage:** Displays the percentage of CPU resources currently in use by the system processes.
- **RAM Usage:** Shows the amount of Random Access Memory (RAM) currently utilized by the system.
- **Disk Usage:** Indicates the percentage of disk space currently used on the system's storage device.
- **Uptime:** Displays the duration of time that the system has been continuously running since it was last started
- **Power OFF:** Executing the power Off will shut down the whole system.
- **Reboot:** Executing it will reboot the whole system.
- **Mainboard FW Update:** Allows for updating the firmware of the main-board.
- **Manufacturer:** Displays the manufacturer name.
- **Model:** Displays the model name.
- **Hardware Version** Display the hardware version.
- **Software Version:** Display the software version.
- **Documentation:** Device documentation can be viewed after scanning the QR code present on the page.

Chapter 5

Android App - RadScope

RadScope (mobile app) is designed to display Gamma Spectrometer monitoring results and serves as a user-friendly interface for accessing and visualizing radiation data captured by the Gamma Spectrometer. its functionalities include:

- **Real-Time Monitoring**
- **Dose Rate Display**
- **Counts Per Second (CPS) Display**
- **Graphical Visualization**

5.1 User Interface

- The **Dashboard** in the Image 5.1 displays radiation dose rates with accuracy to two decimal points in microsieverts per hour, along with CPS Readings and Spectrum Analysis.
- The **Device Parameters** featured in the Image 5.1 includes the Device ID and Device IP address, as well as detailed battery information such as battery percentage, voltage, charging status, current, and temperature.
- The **Settings** page in the Image 5.1 includes Discovery Type, Server Credentials and Alarm. The settings menu displays the application version of the device at the bottom.

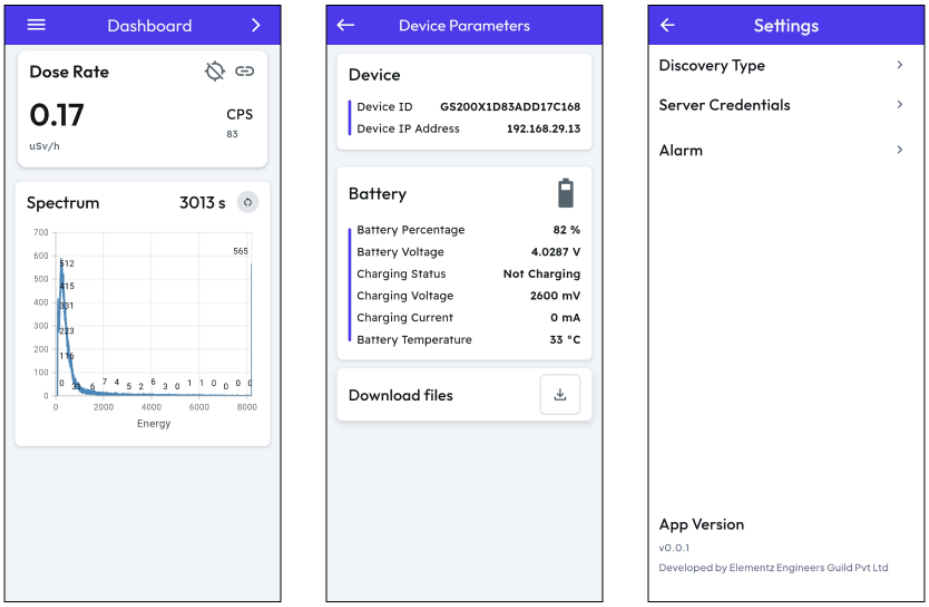

Figure 5.1: User Interface

5.2 Connecting Device with Android App

The following method describes how the device **automatically** connects with the Android app.

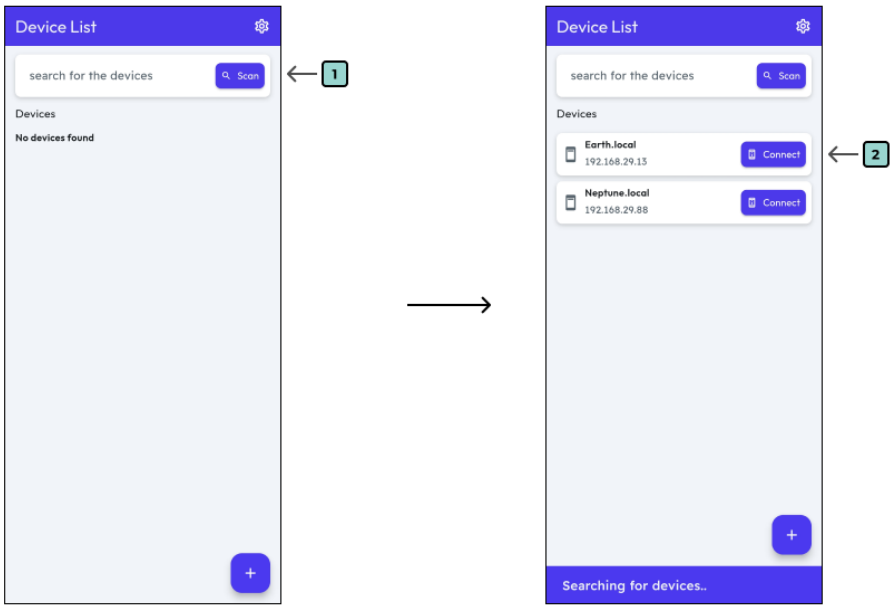

Figure 5.2: Auto-connection with Android App

- In the device list, search for nearby devices by tapping the icon labeled **1**, as shown in the Image 5.2. This action will initiate a scan for any devices within range.

- Once the scan is complete, the names of all available devices will be displayed in a list. To connect to a specific device from this list, simply press the icon labeled **2** in the Image 5.2. This will establish a connection between the app and the selected device.

The following method describes how the device can be **manually** connected with the Android app.

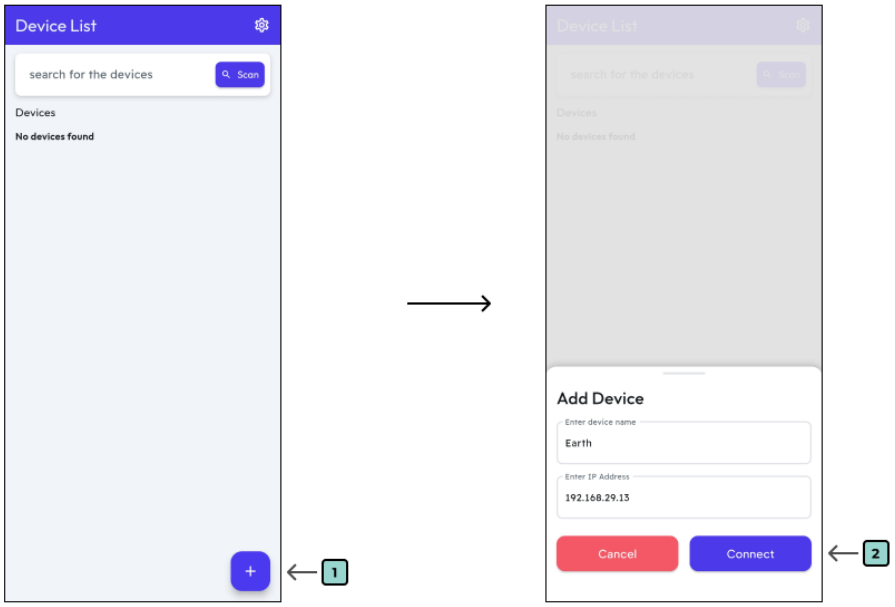

Figure 5.3: Manual-connection with Android App

- From the device list, tap the icon labeled **1** in the Image 5.3. This will bring up the ”Add Device” option.
- When this option pops up, you will have the ability to connect a new device. You can do this by either entering the name of the device or its IP address. Once you have provided the necessary information, the app will establish a connection with the specified device.

  Note: Device IP Address can be found from the **Device Setting** from EGS-T200. Make sure that the Phone running the Android App and the EGS-T200 device is connected to the same network.

Chapter 6

Calibration

6.1 Dose Rate Calibration

Each and every EGS-T200 dosimeter shipped will have a calibration certificate. The devices are calibrated for Dose Rate at **Avantec**, an AERB recognized calibration facility.

- Instrument: 10cc Ion Chamber
- Model: IC10016
- Traceability No: BARC/RSSD/RSS/CAL/C-144/2022
- Radionuclide: Cobalt 60 (60Co)
- Energy / Unit: 1.25 MeV
- Exposure Rate: 25uSv/h, 50uSv/h & 100uSv/h

6.2 Energy Calibration

Energy Calibration will be done in house with 4 points of references. The reference sources are listed below,

Element	**Energy (keV)**
Barium	356
Caesium	662
Cobalt-60	1173
Monazite	2614

List of Abbreviations

NaI(Tl)	Thallium-doped Sodium Iodide)
CPS	Counts Per Second
CPM	Counts Per Minute
mSv/h	Milli Sievert Per Hour
µSv/h	Micro Sievert Per Hour
MHz	Mega Hertz
SOC	State of Charge
IP	Internet Protocol
FW	Firmware
AT	Acquisition Time
DPI	Delayed Pause Interval
USB	Universal Serial Bus
PD	Power Delivery
HVDCP	High Voltage Dedicated Charging Port
DPPM	Dynamic Power Path Management