Supplemental Manual

SWARM MESA®

Research Electronics International, LLC

SWARM MESA®

Supplemental Manual

This document is intended to provide guidance and instruction on using the SWARM MESA™ to protect a user-determined Area of Interest (AOI) and detect RF signals in the given area.

This manual contains proprietary information intended solely for use with the SWARM MESA™ product.

The overall effectiveness of this product, and of any surveillance countermeasure, is dependent on the threat level and the user's ability to properly use the appropriate equipment.

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Revision 1.2

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SWARM MESA® Kit Case Contents

First layer

1) Laptop sleeve
2) Laptop (inside sleeve)
3) 4 MESA units

Second layer

4) Plastic box containing:
   a) SWARM software USB key
   b) 5 WiFi 5 USB adapters
5) 4 Omni-directional antennas
6) 6 Ethernet cables
7) Laptop power supply
8) 4 MESA power supply adapters
9) 4 Power supply plug adapters

SWARM MESA® Cable Kit Case Contents

1) 7 Retractable Ethernet cables (large)
2) REI clamshell case (left, containing #3 & 4)
3) Ethernet switch
4) Ethernet switch power adapter
5) REI clamshell case (right, containing #6)
6) 7 Retractable Ethernet cables (small)

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General Description

The SWARM MESA™ is a system of MESA 2.0™ units tethered by Ethernet to a computer software system (SWARM) that assimilates RF signal input and compares these signals by both location and time to monitor for emerging potential threat devices. The SWARM MESA requires four to five MESA units for the protection of a user-created Area of Interest (AOI). A single MESA unit is placed inside the AOI, with three to four MESA units placed outside the AOI. Typical use will see the AOI as a single room. In this guide, the MESA placed within the AOI will be referred to as the AOI MESA. Units placed exterior to the AOI will be referred to as Sensor MESAs.

Events, such as meetings, are protected by a Mission. Missions can either be ongoing (constant AOI protection without a scheduled end) or set for a defined period of time (see p. 23). A Mission can be created ahead of time with signal filtering for background RF (e.g., a radio station). Similar to a reference trace in MESA's SmartBars™ mode (see MESA 2.0 User Manual, p. 44), the Mission will collect an environmental reading for signals prior to an event and then monitor for new signals entering the area during an event. The Mission, however, will continue to compare past signals (the environmental reading) with present signals and current inside signals compared with current outside signals. It will present the user with alerts for new potential threat signal incidents as they appear. Geolocation and signal data are available in real-time. All signal data collected during the Mission will be saved for later analysis.

SWARM MESA® Kit Contents Description

The SWARM MESA case contains four MESA units, four omnidirectional antennas, five Wi-Fi 5 USB adapters, a laptop containing SWARM software, and a software USB key. Additional MESA units can be purchased from REI.

MESA Units

The MESA units are fully functional MESA 2.0 units that can be used individually as needed. (Please refer to the MESA 2.0 User Manual for guidance on this type of use.) For this guide, the MESA units should be placed in Spectrum Mode and connected via Ethernet cables to a computer running the SWARM software. See p. 9.

Omnidirectional Antennas

The Omnidirectional Antenna is designed to receive signals from all directions perpendicular to the antenna. This will allow the SWARM MESA system to detect and geolocate signals to best protect the Area of Interest. Please use only the Omnidirectional Antenna with the SWARM MESA system.

Frequency range: 30 MHz – 6 GHz

Note: Low-end antenna frequency performance: The Omnidirectional Antenna performance rolls off from 450MHz to 50MHz by approximately 20 dB, but the antenna is usable even below 30MHz.

SWARM Laptop

A laptop computer with SWARM software installed is included in the SWARM MESA product. This software requires the SWARM software key, also included. Insert the software key into the computer's USB port.

Wi-Fi 5 USB Adapter

For use with the SWARM MESA, REI has provided Wi-Fi adapters. These are needed for the system to coordinate timing data for geolocation and data packet information. Insert one into each MESA unit via

one of the two USB ports located at the top of the unit. The MESAs have built-in capability for Wi-Fi, but that feature is not intended for SWARM MESA use.

Please note: The button feature on the back of the Wi-Fi dongle is not used by the MESA. Take care not to press it, as it will implement options that may interfere with the SWARM MESA system.

SWARM Software USB key

The USB key is required to use the SWARM software.

Use of Additional Search Probes

When useful, additional probes can be used with the MESA for physical searches (available from REI at reiusa.net). Alerting signals can be traced to individual devices present within the AOI. For description and use of these probes, please see the 2.0 MESA User Manual (beginning at p. 13). When using a MESA to search for a device, please do the following:

1) Unlock the screen by entering the password (created below, see p. 12).
2) Select the desired mode and appropriate probe to physically search for the device (see pp. 13-17 of the MESA 2.0 User Manual)
3) When finished, reconnect the MESA unit to the Ethernet cable and power supply
4) Restart the ***API*** by selecting the **API** tab
5) Press **Start**

SWARM MESA Physical Installation

The SWARM MESA system uses direct Ethernet connections and includes six Ethernet cables (in the main case). The second case contains seven retractable Ethernet cables, an Ethernet switch, and the switch power supply. To prepare the MESAs for installation:

1) Connect MESA units to external power
2) Insert the Wi-Fi adapters
3) Attach the Omnidirectional antennas to the MESA units

Place and Connect the Computer

After selecting the location from which the AOI will be monitored, connect the laptop to its power supply and connect the Ethernet cable.

Place and Connect the MESA Units

Place the AOI MESA inside the Area of Interest. Place the Sensor MESAs in areas outside the boundaries of the AOI, keeping these guidelines in mind:

1) Place Sensing MESA units in a non-square arrangement. Vary the distance and vector of each sensing MESA unit from the AOI MESA unit. A trapezoidal arrangement (if using 4 Sensing MESAs) would be a good practice.

2) Avoid allowing large metal objects (filing cabinets, refrigerators, etc.) between the AOI MESA and the sensing MESAs. This may interfere with the SWARM MESA's ability to detect and geolocate signals.

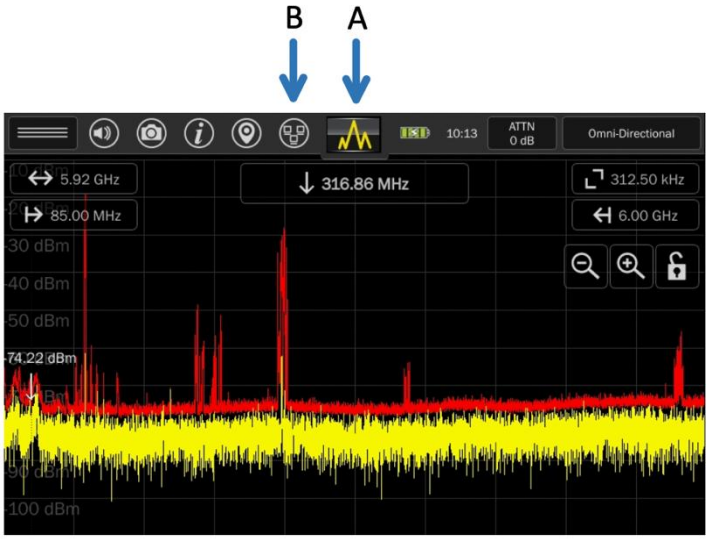
3) If the AOI contains external windows, it may be desirable to eliminate radio frequencies after using Quick Setup to create a Mission. See p. 23 for instructions.

4) Place all MESA units at desktop level for the best signal reception.

5) Take care to place Ethernet and power cables in a manner to avoid tripping hazards or unintended disconnection.

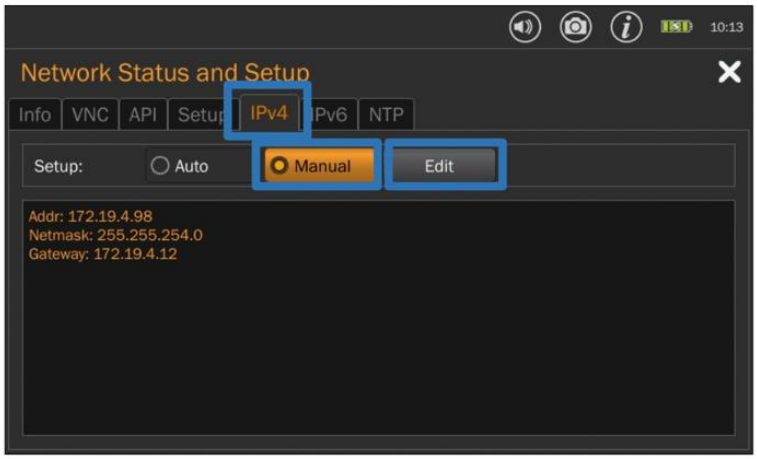
Connect Laptop to MESA Units

1) Prepare each MESA unit for connection:
    a. If not already selected, place MESA in Spectrum Mode
    b. Press the **Network Settings** icon



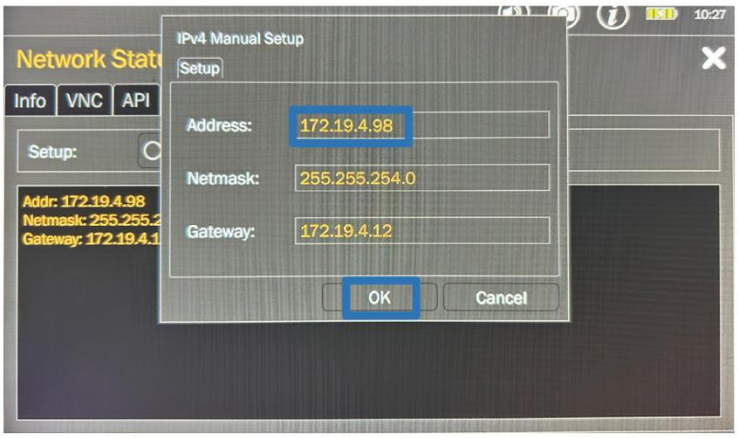
2) Each MESA will need a unique IP address. Obtain these IP addresses from the building's IT department. The first three of the four octets will need to match the IP address ("ipconfig" address) set by the computer in the above procedure. To set the IP address for each MESA unit, perform the following steps:

    a. Select the IPv4 tab
    b. Ensure **Manual** is selected
    c. Select **Edit**



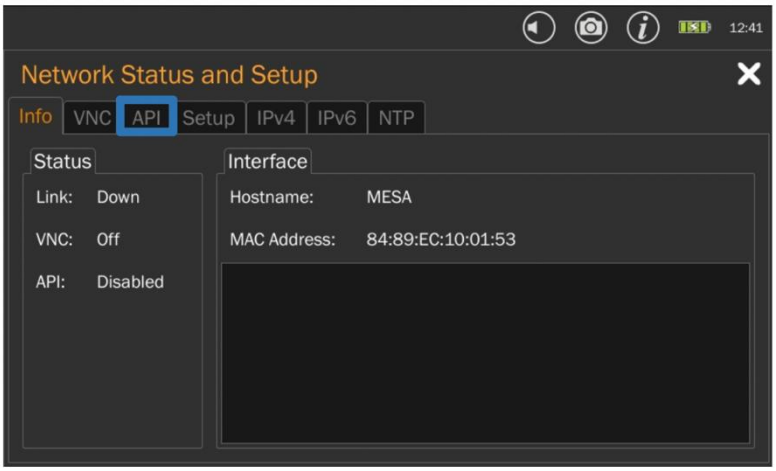
    d. In the next screen, enter the assigned unique IP address for that MESA

e. Click OK

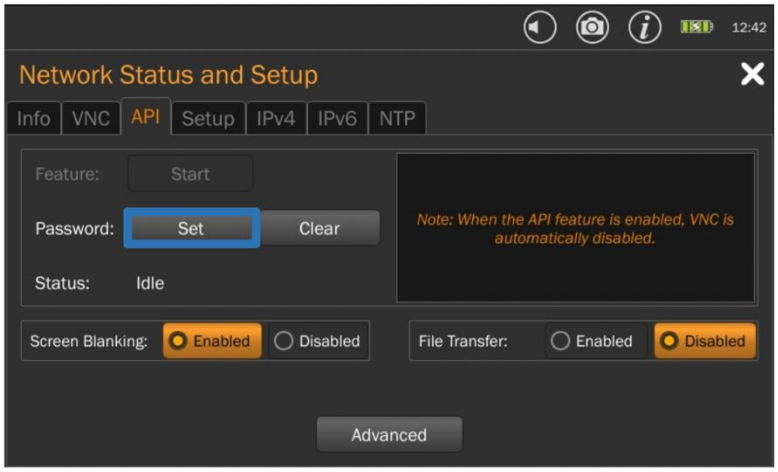


3) Start the API

a. Select the **API** tab



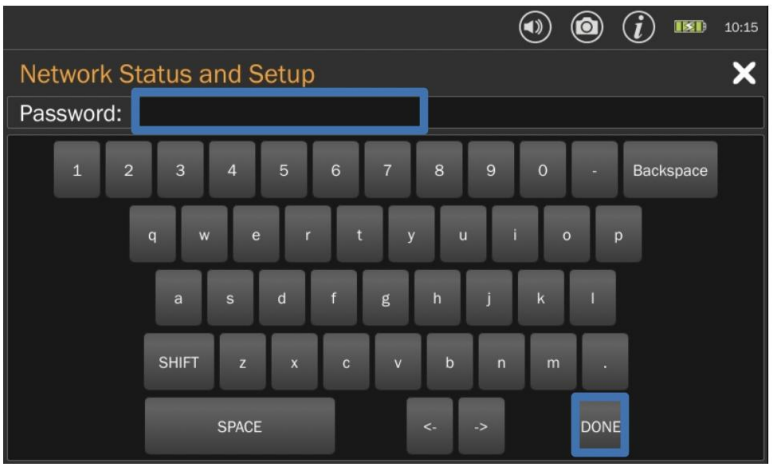
b. Select **Set**



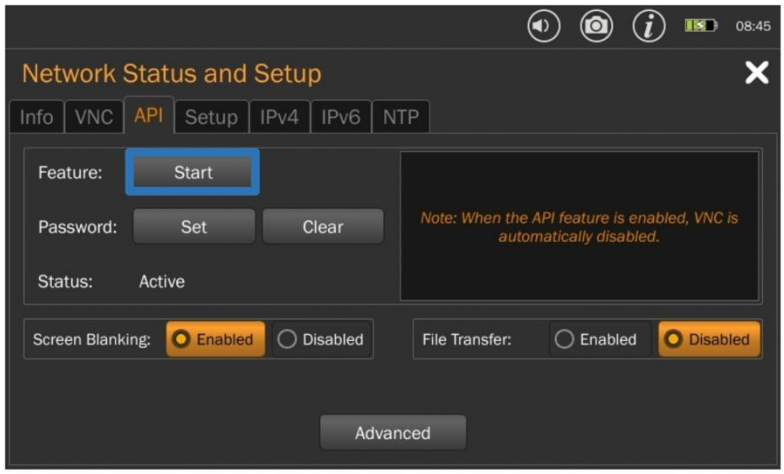
c. Create and enter a password

Please note: When creating and entering a password, take care to enter it correctly and record it in a secure place. *There is no way for the user to unlock a locked MESA unit without the password*. If the password is lost, please contact REI at Tel: +1 931.537.6032 for assistance.

d. Select **Done**



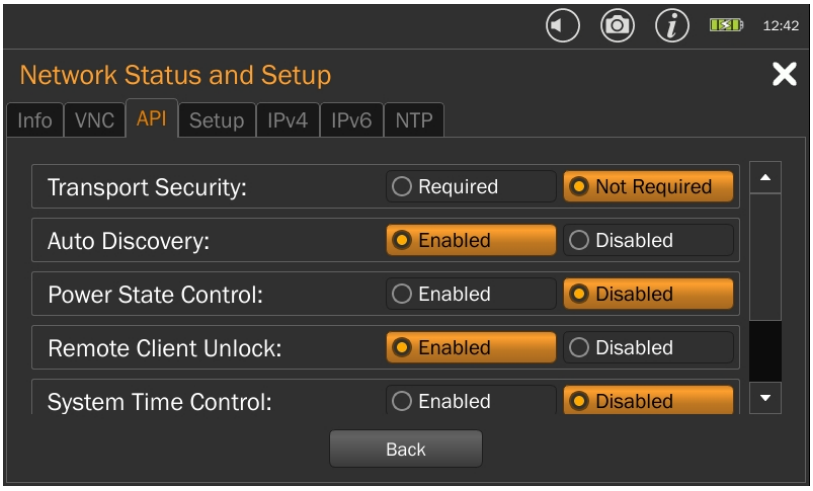
e. Select **Start**



4) Repeat steps 1-5 for all remaining MESA units

The screens will all now display “Locked for Remote Operation.” To unlock unit(s), press **Unlock** and enter the password.

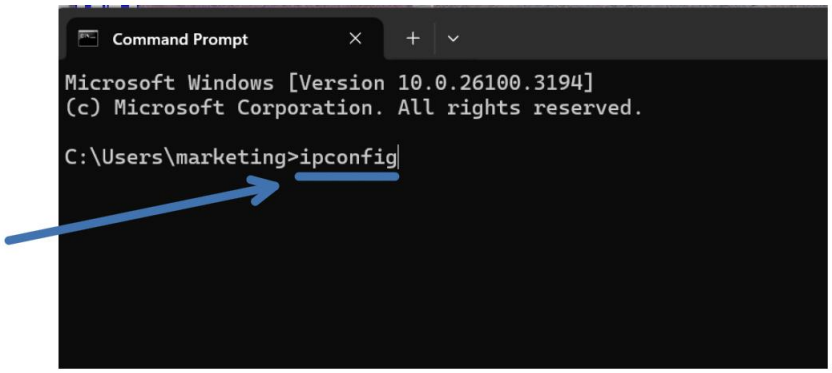
NOTE: Leave ***Advanced*** settings at default, *especially* ***Transport Security***. Should these settings be inadvertently changed, refer to this screenshot to return them to default:



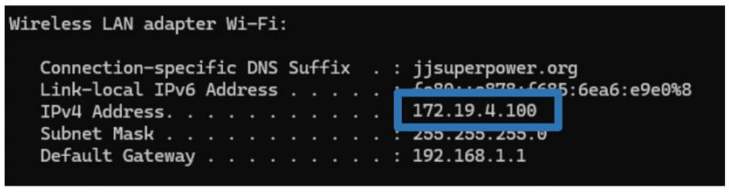
Set Network Time Protocol (NTP)

The SWARM system will set the NTP on each connected MESA unit. To implement this, please follow these steps:

1) Obtain the computer IP address:
    a. In the command prompt window, type: “ipconfig” and click **Enter**

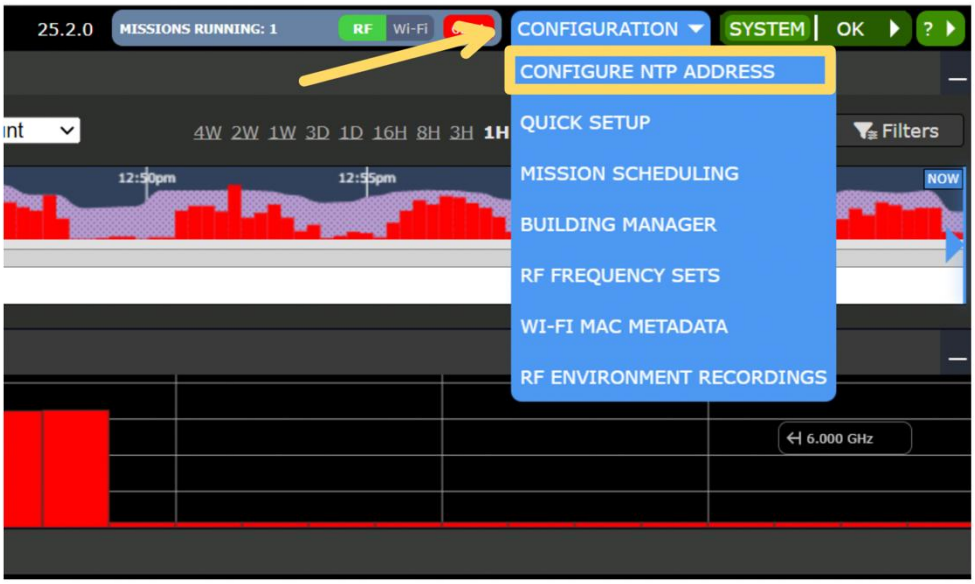


    b. Record the IP address following ***IPv4*** to use in the next steps
    This number: 172…etc, is only for illustration. The NTP number will vary by situation.

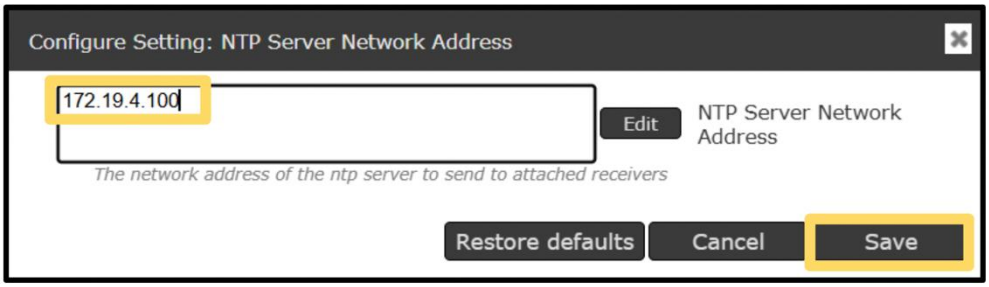


2) Set the NTP under **SWARM Settings**

a. Under ***Configuration***, select **CONFIGURE NTP ADDRESS**



b. In the pop-up box, edit the address to reflect the number obtained in Step #1



c. Click **Save**

SWARM Software Setup and General Use

Quick Setup Feature

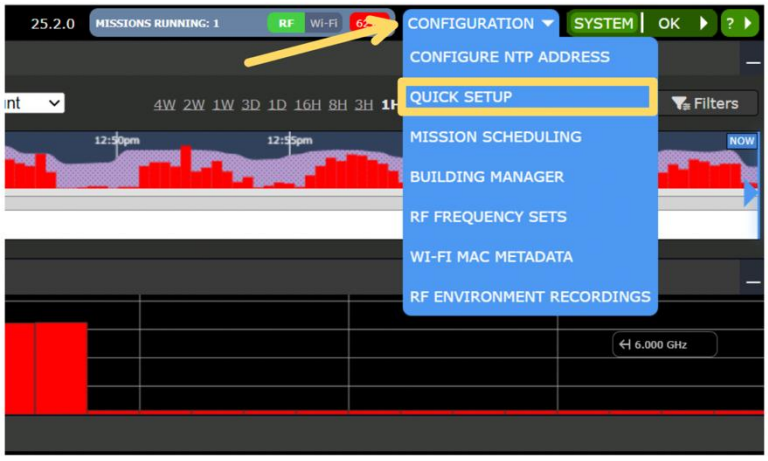
Before using Quick Setup, confirm that all MESA units are powered, connected by Ethernet, assigned unique IP addresses, and visible to the SWARM software. The following procedure assumes the physical installation and network configuration have already been completed.

The SWARM software provides the **Quick Setup** feature — a guided step-by-step process to set up a Mission in a new location. This guided process is intended for new environments, such as a new building, floor, etc. It will guide the user through creating a target area, an Area of Interest (AOI), and its surrounding area (for Sensor MESAs). Use ***Mission Scheduling*** (p. 23) to create new missions for the same environment. It is only necessary to use the ***Quick-Setup*** feature when in new environments.

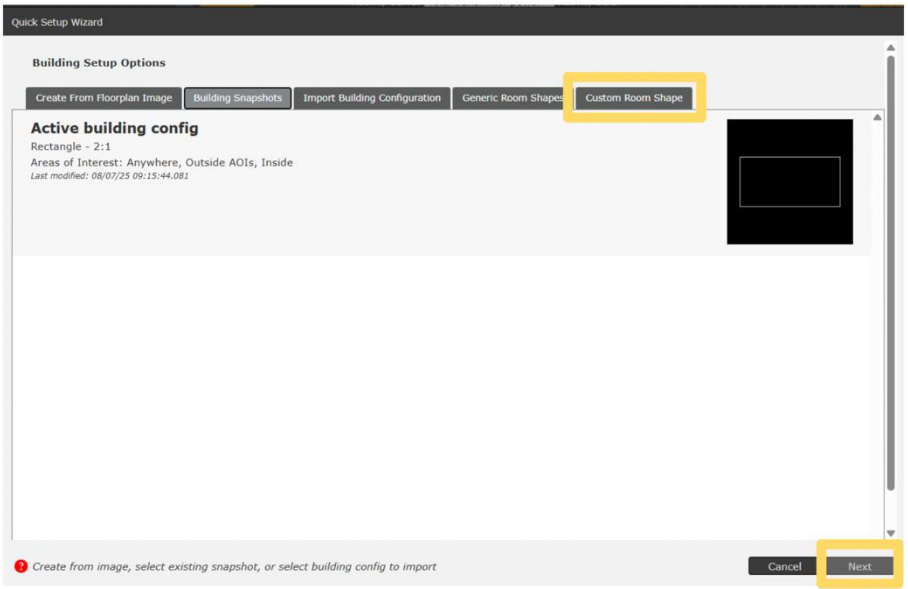
Please note: This initial version of the SWARM MESA user manual will describe only the most basic instructions. Many more SWARM features are available but not covered in this manual version. Please contact REI for the availability of training courses and further literature.

Once the system is physically deployed, use the **Quick Setup** feature by following these steps:

1) Under ***Configuration***, select the **Quick Setup** option

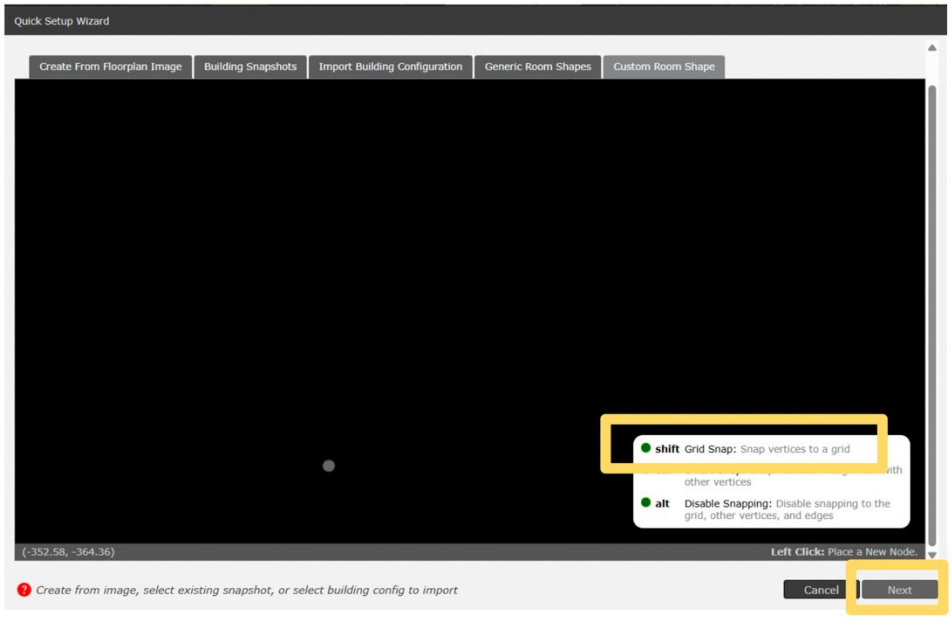


2) **Building Setup Options**
   a. Select the **Custom Room Shape** tab
   b. Select **Next**



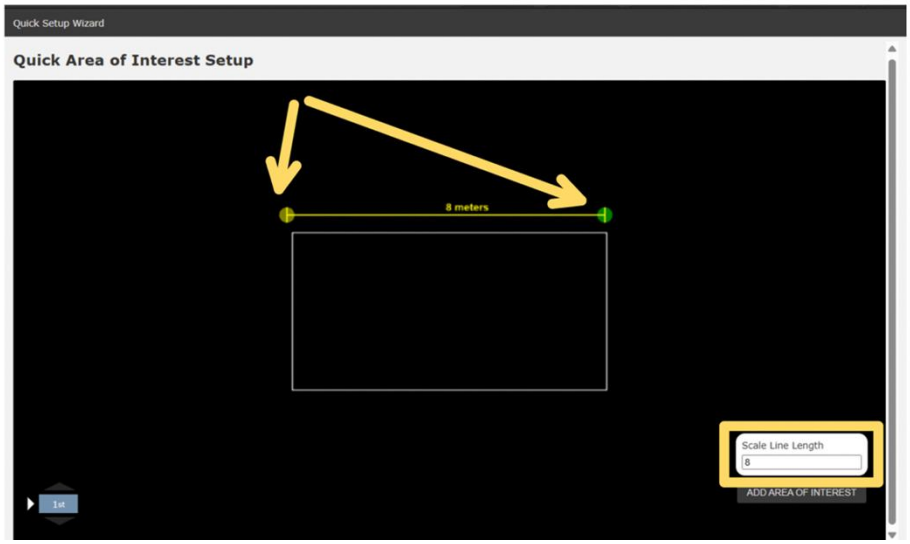
   c. Press the **Shift** key.

d. In the grid that appears, create the room or area to be monitored

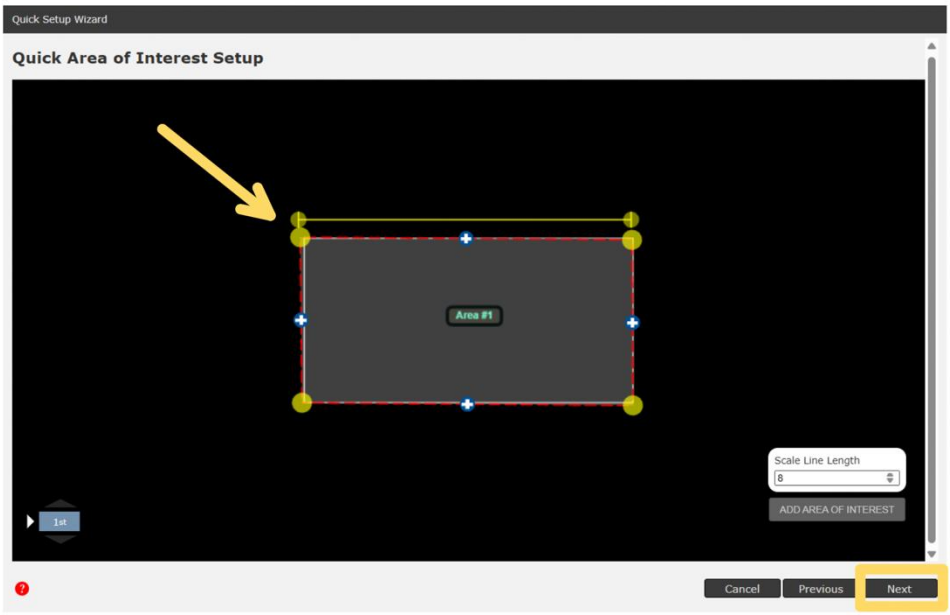


e. When the desired shape is completed, click **Next**

f. Adjust the scale line to match one wall of the perimeter. Adjust the meters to match the wall length.

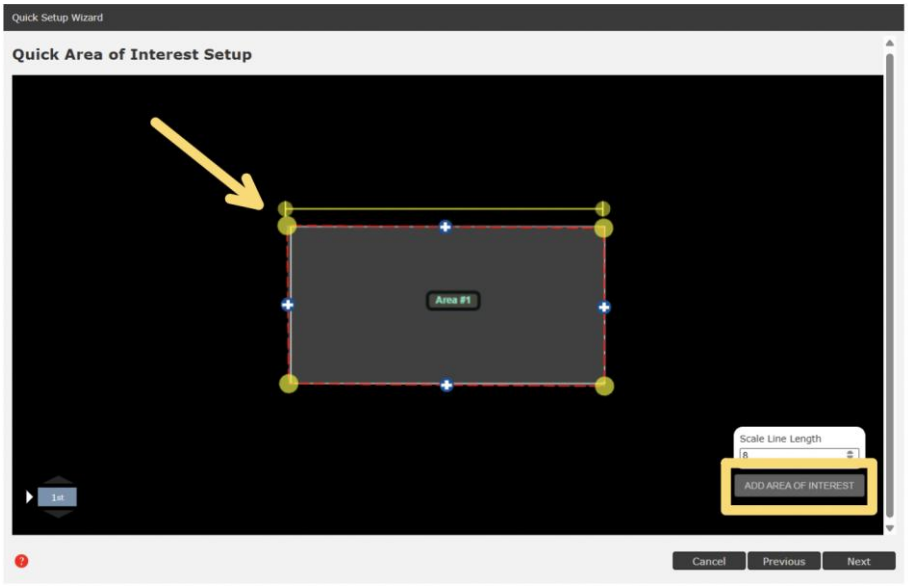


g. Click **Add Area of Interest** below the ***Scale Line Length***



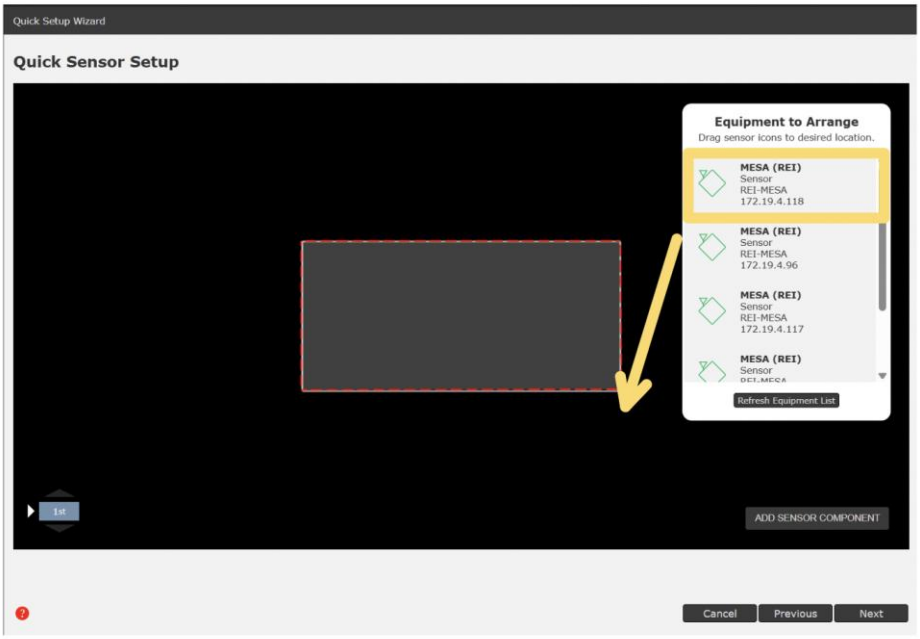
h. Drag the ***Area of Interest*** corners to match the area to be monitored

i. Click **Next**

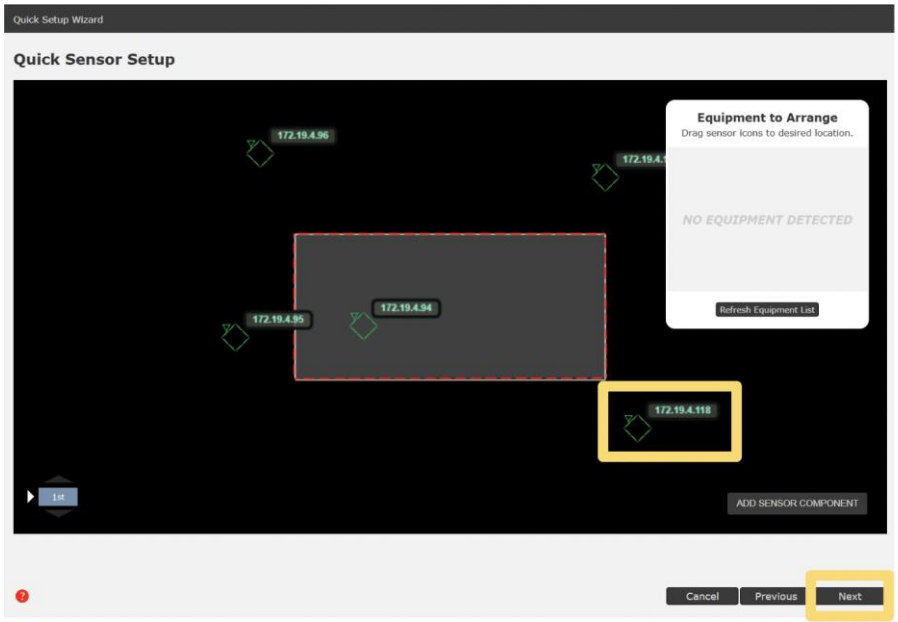


3) Quick Sensor Setup

From the pop-up box, drag and drop a MESA to the desired location. It will be identified by the IP address assigned to it by the IT department (see p. 10)

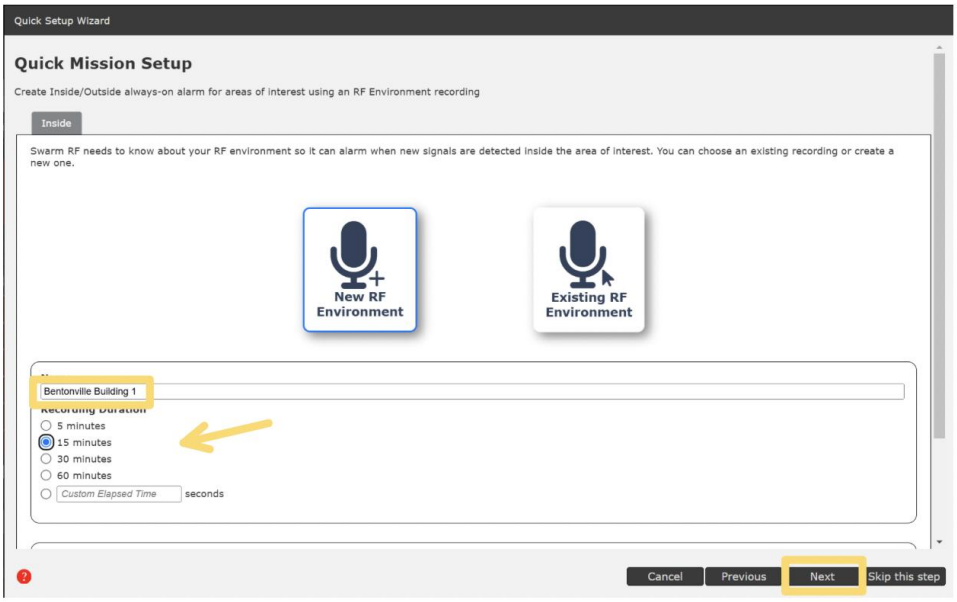


a. Continue until all MESA units are placed, representative of their real locations
b. Click **Next**



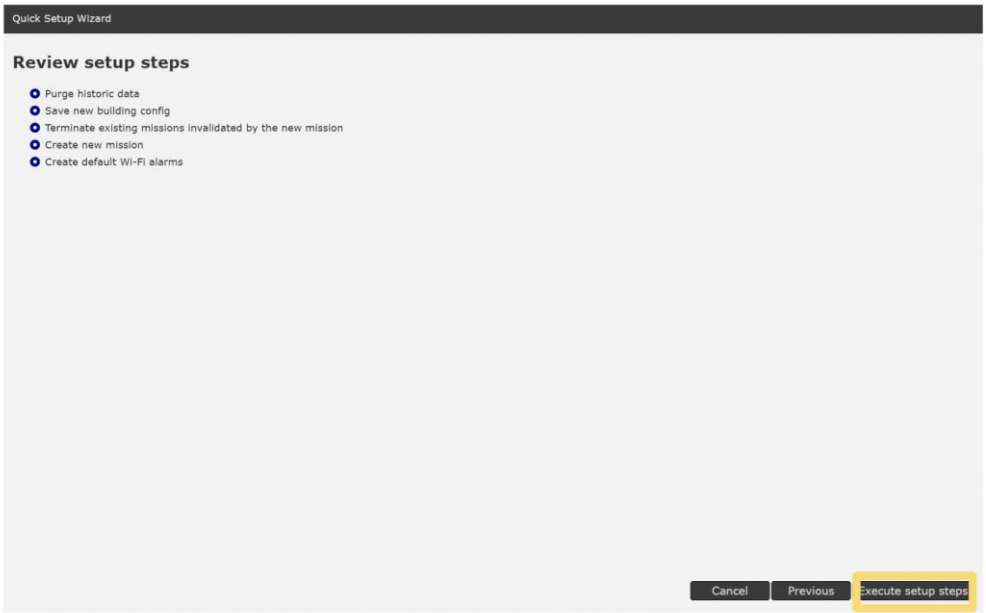
4) Quick Mission Setup

a. Select **New RF Environment**
b. In the **Name** box, enter a descriptive name (required)
c. Select a preset length of time (or create a custom time) to take a background RF baseline reading
d. Click **Next**



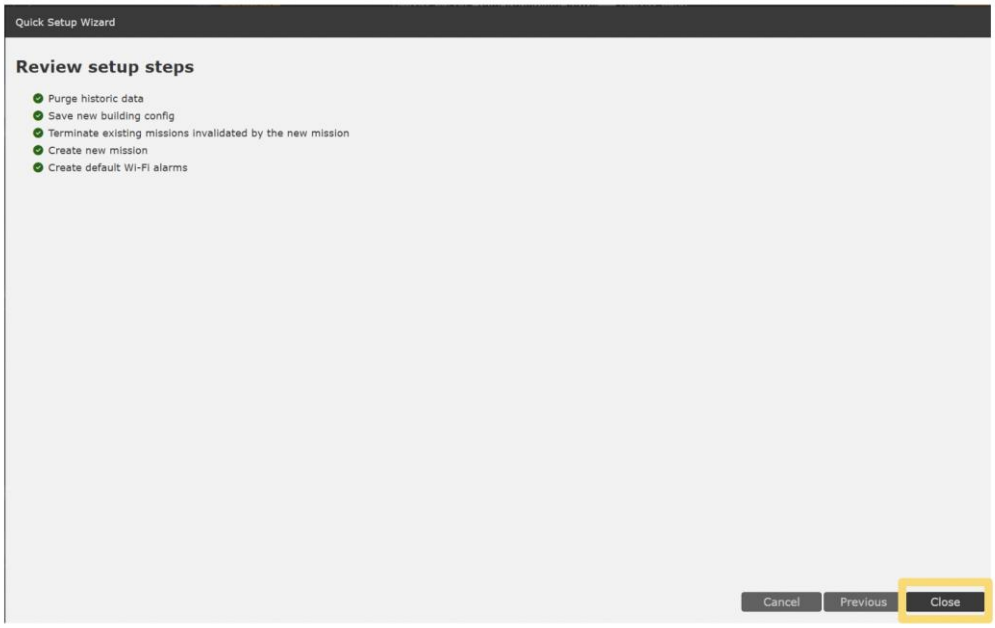
5) Review Setup and Steps

a. A list of setup steps to be performed is presented
b. Confirm these steps are desired
c. Click **Execute setup steps**



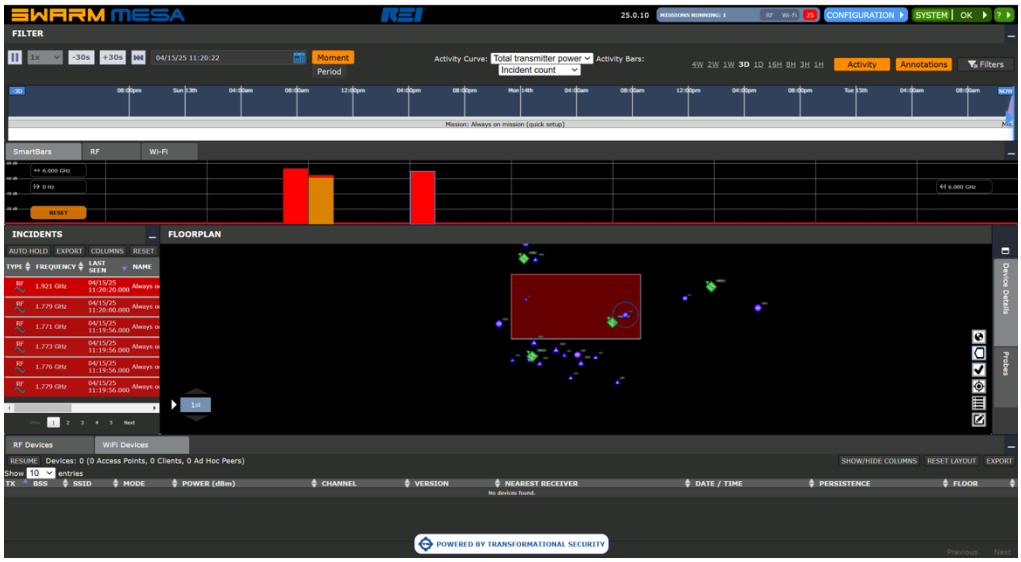
d. The list will show the completed steps

e. Click **Close**



6) **SWARM**

The SWARM monitoring software screen should appear like this:

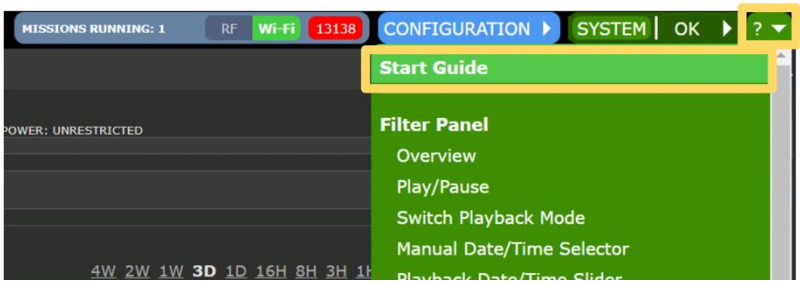


Start Guide Feature

The SWARM software system contains a tutorial to help the user familiarize themselves with the elements and features of the SWARM Mission home screen. Once the Mission has been created, step through the tutorial for a description of each feature of the home screen.

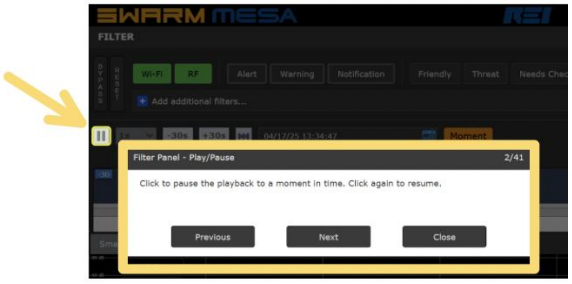
To begin the Start Guide:

1) Click on the **?** help icon (top right of screen)
2) Select **Start Guide**



3) A screen element will be highlighted, and a pop-up box explaining the feature will be displayed

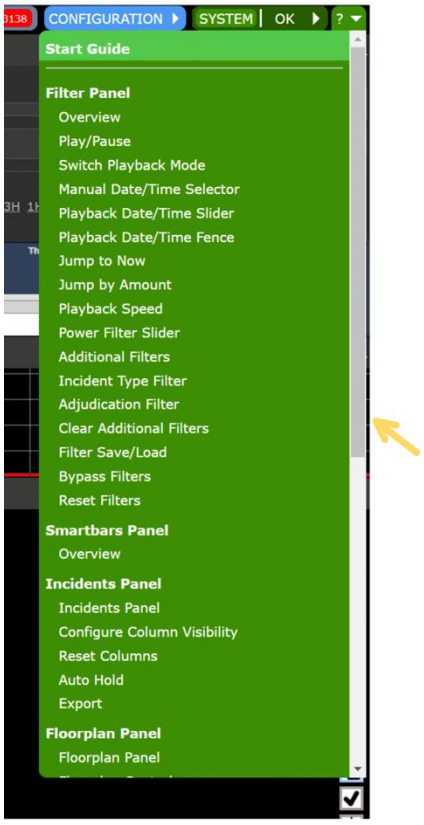
4) Select from the options of: Previous, Next, or Close



5) Continue through all the screen elements and features

Or

6) Return to the **?** help icon and choose a specific element from the dropdown menu. Use the slider bar to access all items in the menu.



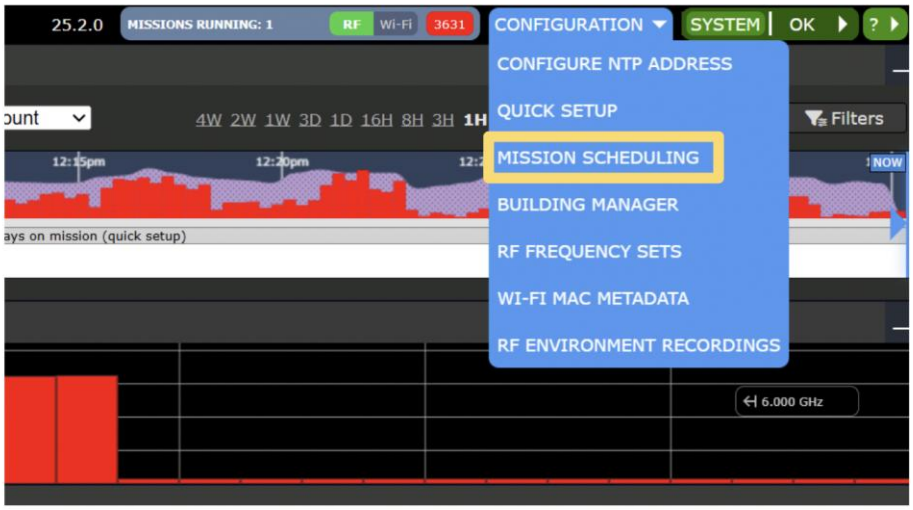
Creating and Scheduling Missions

Missions can be created and scheduled on the Mission Calendar to prepare for future events. These will use the building configuration created when a new environment was first encountered. (New locations will need new building configurations and environmental recordings.)

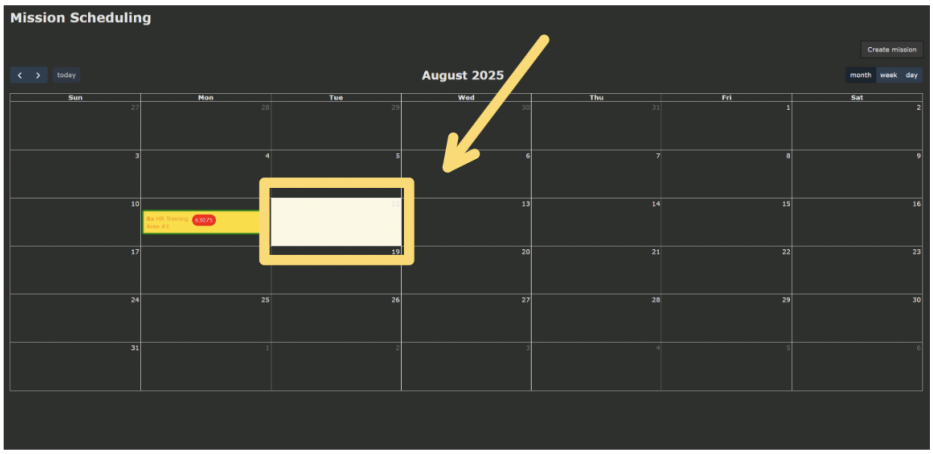
Creating a Mission

In situations where the SWARM system has been set up in a particular location and the Building Configuration setting area remains as desired, but a new event is about to take place, a new mission can be created. It is not necessary (and is even undesirable) to use the Quick Set-Up process for this situation (see p. 15). Quick Set-Up is designed for new environments only. To create a new mission:

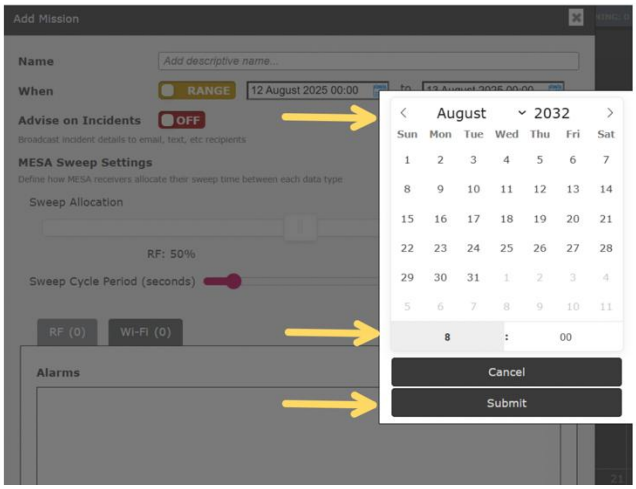
1) **Schedule the Mission**
    a. From the ***Configuration*** menu, select **Mission Scheduling**



    b. Select the date



c. Create start/stop dates and times, and then select **Submit**

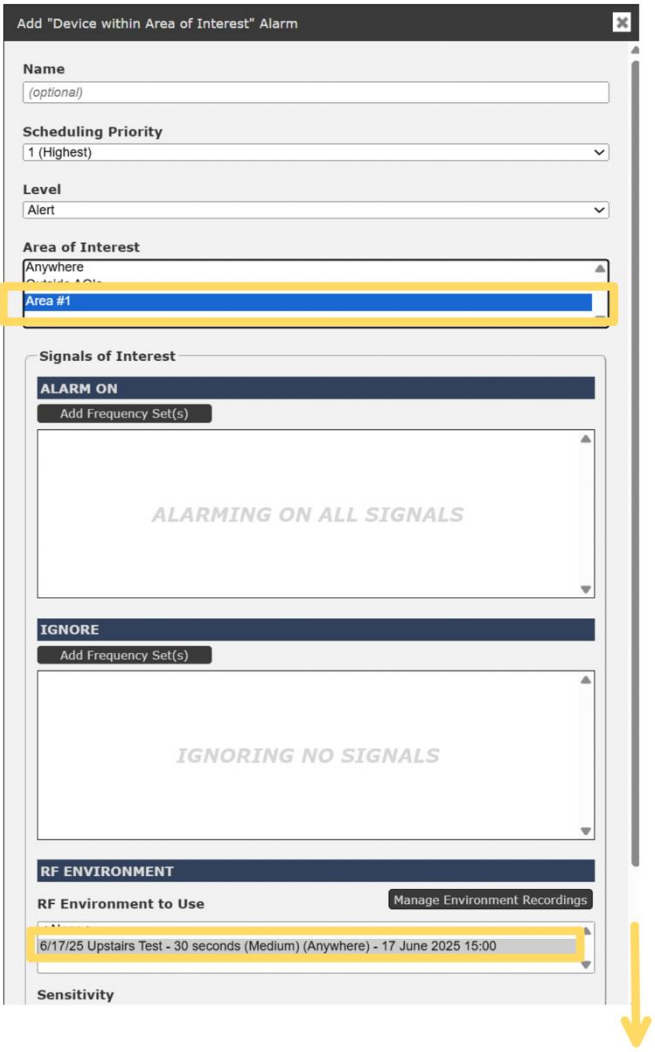


2) Set RF alarm

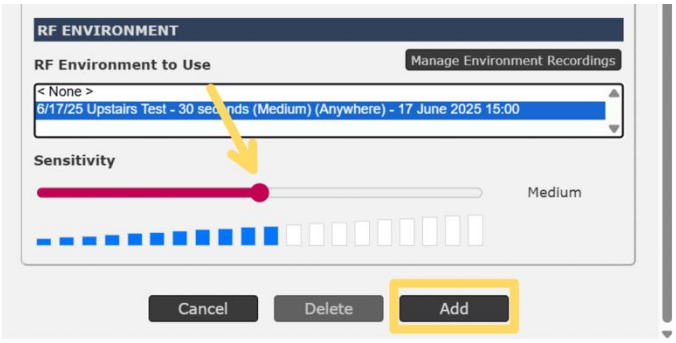
a. Select the **RF tab**

b. Select **Add RF Alarm**

c. Suggested RF settings:
    i. Scheduling priority: 1 (Highest)
    ii. Level: Alert
    iii. Area of Interest: Area #1
    iv. Signals of Interest (optional): create ***Alarm On*** or ***Ignore*** sets



    v. Select a previous environmental recording
    vi. (scroll down)
    vii. Sensitivity: leave at medium

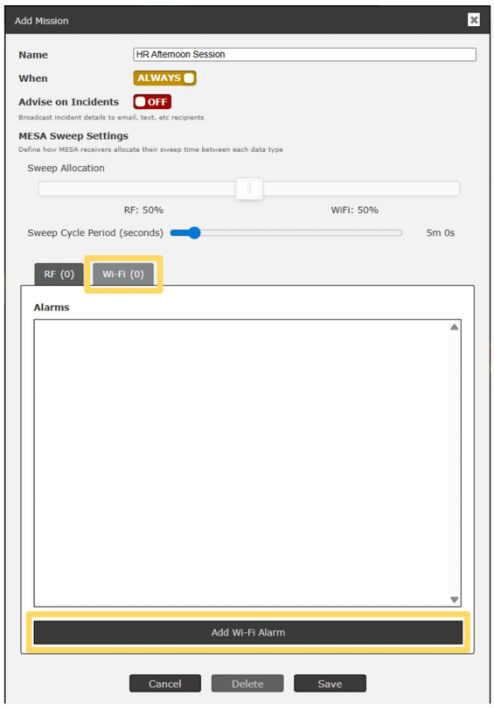


viii. Click **Add**

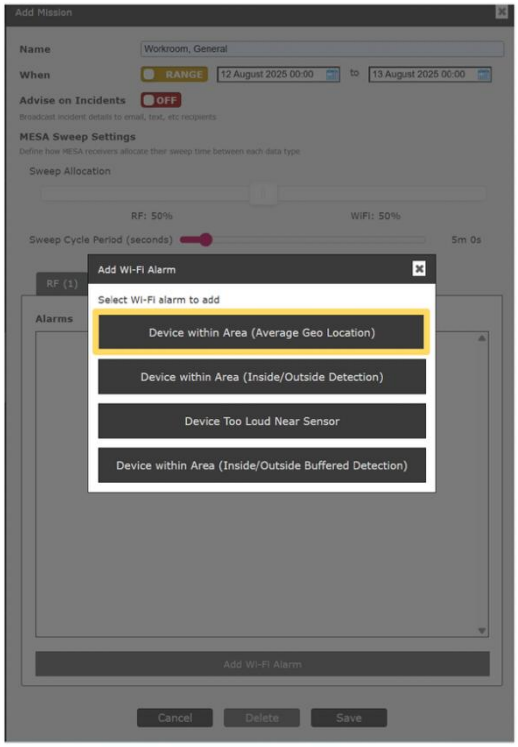
ix. Returning to the page, click **Save**

3) **Set Wi-Fi alarm**

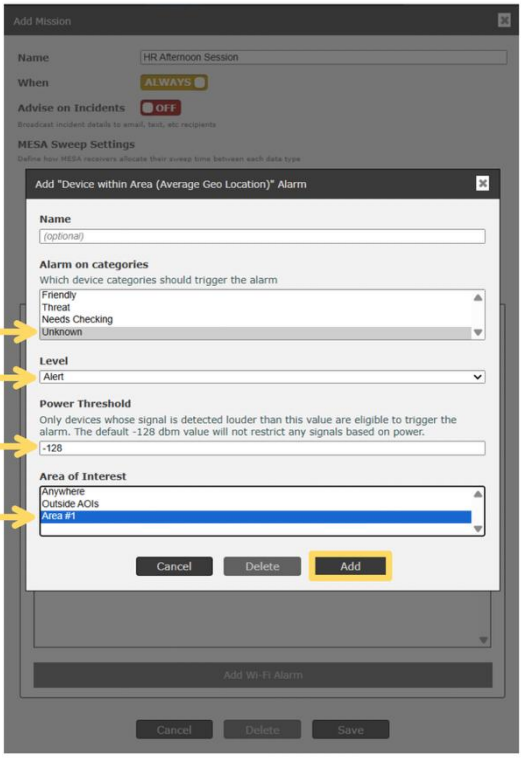
a. Select the **Wi-Fi tab** and then **Add Wi-Fi Alarm**



b. Select Wi-Fi alarm to add: Device within Area (Average Geo Location) (suggested setting)



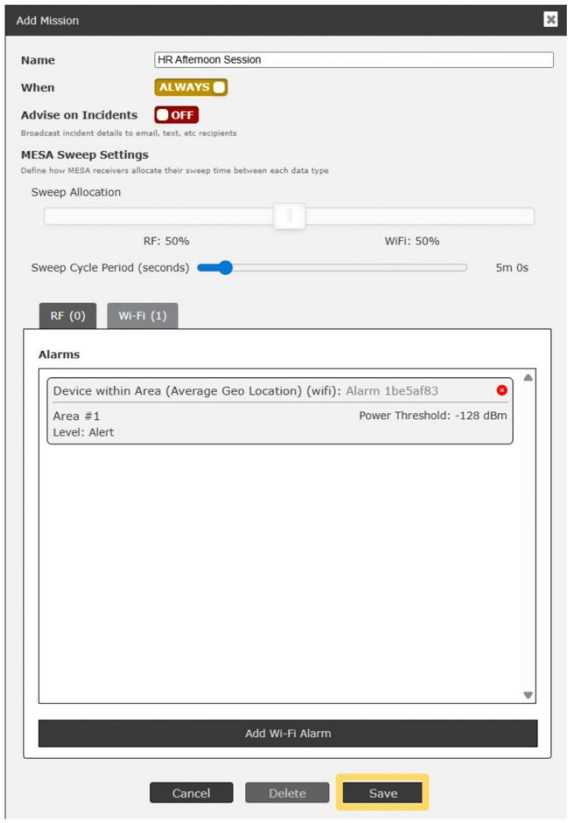
c. Choose settings (suggested settings):



i. Name: (*optional*)

ii. Alarm on categories: Unknown
iii. Level: Alert
iv. Power Threshold: leave at -128
v. Area of Interest: Area#1
vi. Select **Add**

d. Select **Save**

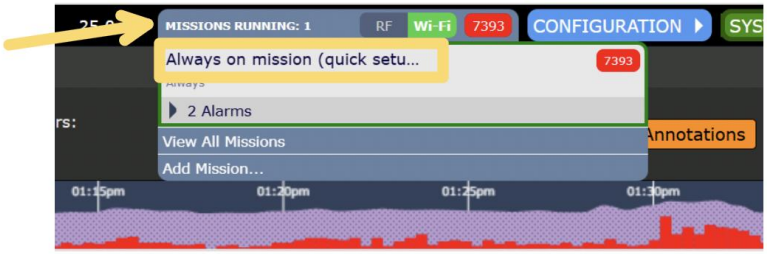


Please note: These are only suggested settings and can be altered by the user to suit the environment and event.

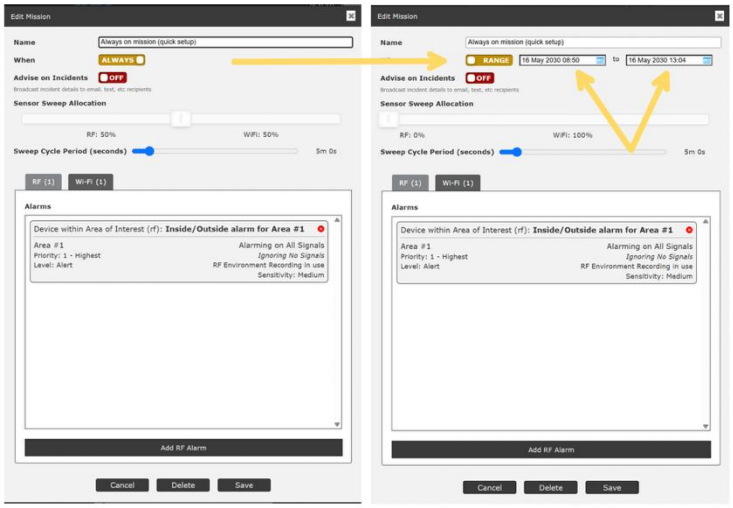
Scheduling an Ongoing Mission

When using the Quick Setup feature, Missions are ***Always On Mission*** (ongoing) by default. If desired, these can then be scheduled for a determinate future time. This can be helpful after setting a mission's parameters to then schedule it for a future event. Keep in mind that two missions cannot occur at the same time. Ongoing missions prevent a second mission from being created.

1) Hover the mouse over the **Missions Running** tab
2) In the drop-down list, select the **Always On Mission**



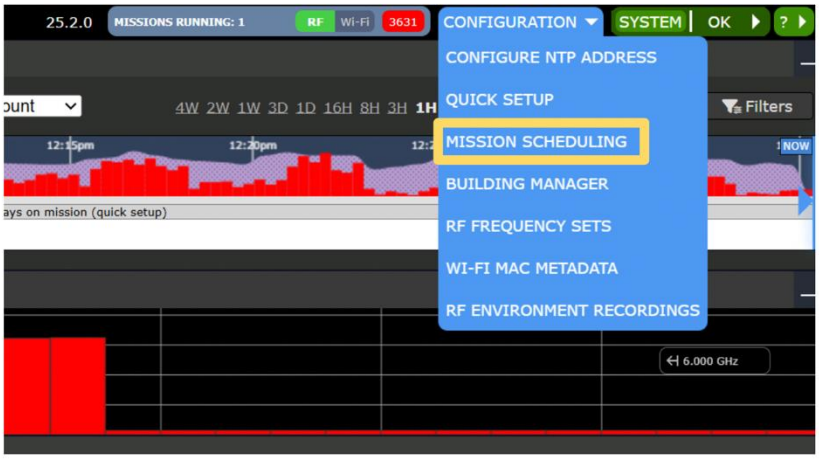
3) In the pop-up window, select **Always** and toggle it to **Range**
4) Schedule the beginning and end (date and time) in the fields that appear



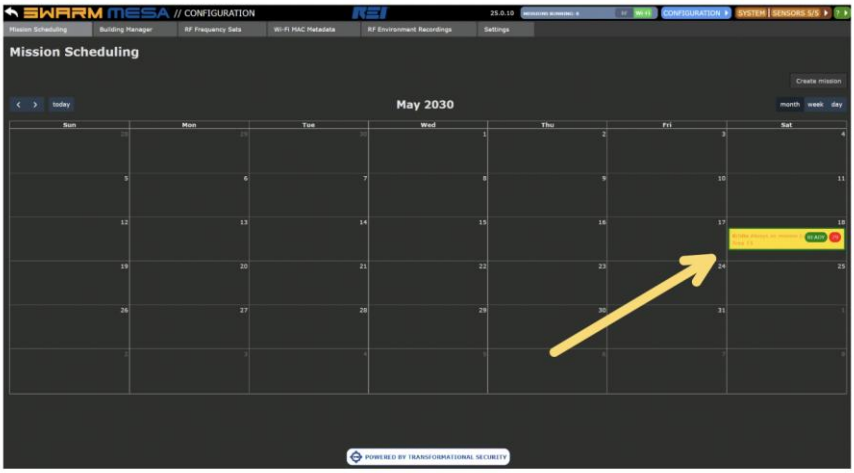
5) Click **Save**

To confirm a scheduled mission:

1) Select the **Configuration** tab and from the drop-down menu, click on **Mission Scheduling**



2) The Missions Calendar will appear. Confirm the Mission is scheduled as desired. Missions can be modified from the calendar view by double-clicking on the scheduled mission. The Mission window will appear.



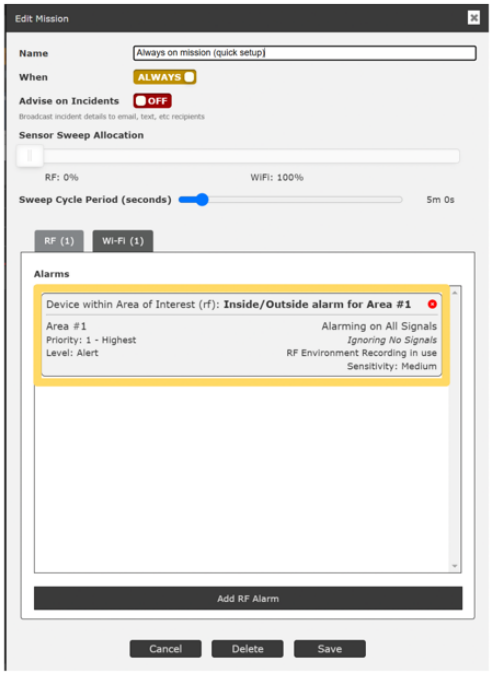
Editing Alarms

When the Mission is set up, the user may wish to customize a default alarm. For example, as mentioned during the physical setup, it may be helpful to ignore radio station frequencies for an AOI containing windows.

For this example, to ignore radio station frequencies (see p. 9), follow this procedure:

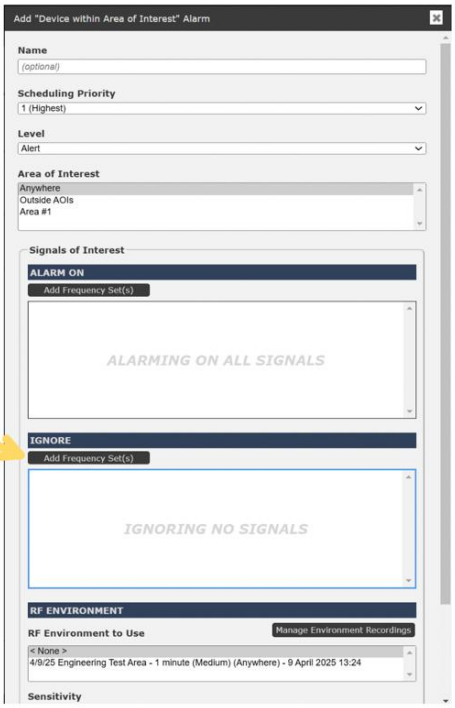
1) In the control bar at the top, from the ***Missions Running*** tab, select the gray box

2) **Edit Mission** pop-up window will appear
   a. Confirm the **RF** tab is selected
   b. Click within the alarm box to be edited



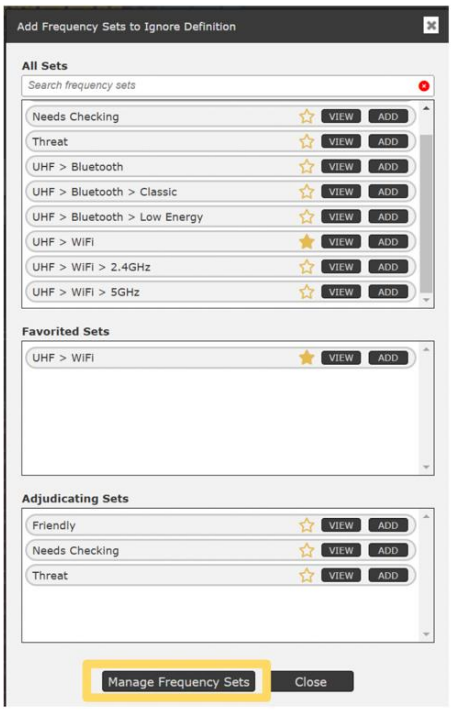
3) **Update "Device within Area of Interest" Alarm** pop-up window

a. Under ***Ignore***, select **Add Frequency Set(s)**



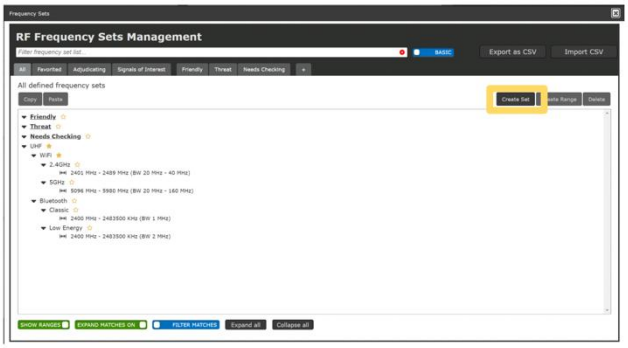
4) **Add Frequency Sets to Ignore Definition** pop-up window

a. Select **Manage Frequency Sets**

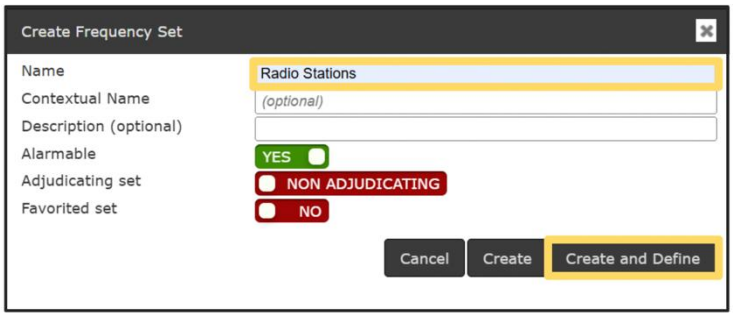


5) **RF Frequency Sets Management** pop-up window

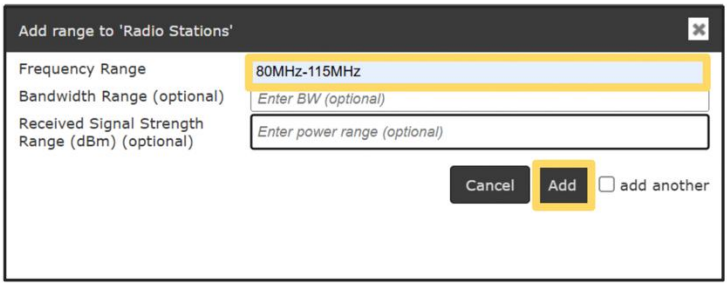
a. Select **Create Set**



6) **Create Frequency Set** pop-up window
   a. Enter a **Name**
   b. Select **Create and Define**

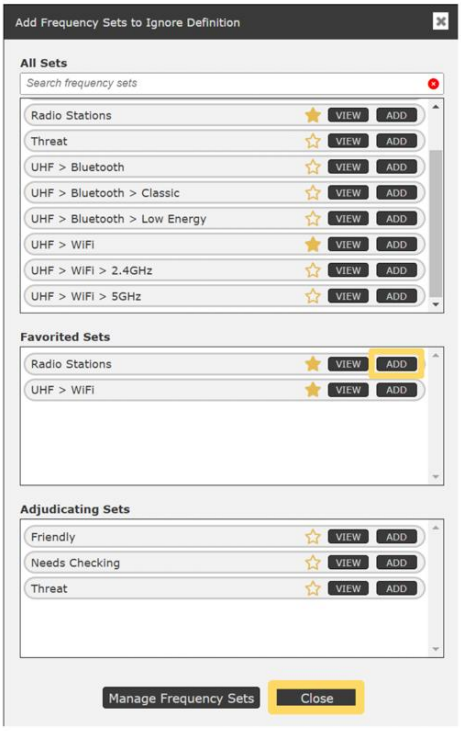


7) **Add range to 'Radio Stations'** pop-up window
   a. Define desired frequency range
   b. Click **Add**



8) Close **Frequency Sets** pop-up window by clicking **X**
9) Returning to **Add Frequency Sets to Ignore Definition**
   a. Select the frequency set defined earlier (in this example, **Radio Stations**)
   b. Click **Add**

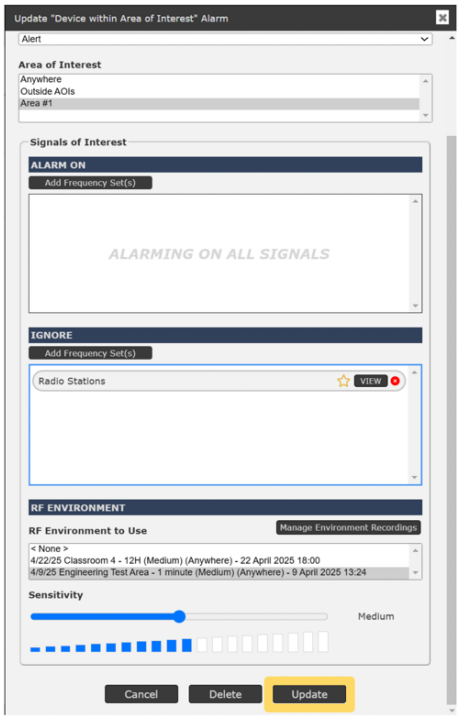
c. Click **Close**



10) Returning to **Update "Device within Area of Interest" Alarm** pop-up window

a. Scroll to the bottom

b. Click **Update**



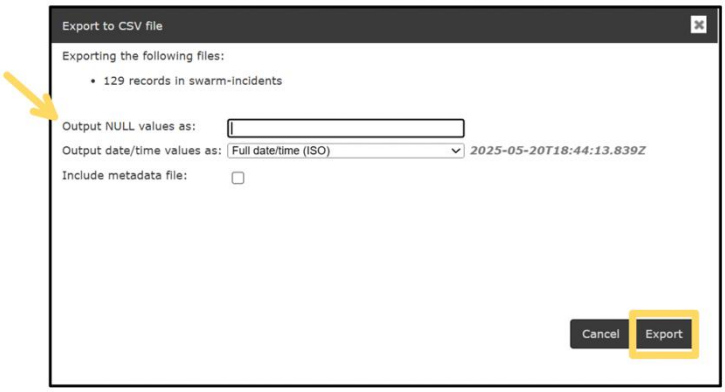
11) Returning to the **Edit Mission** pop-up window
    a. Confirm the alarm is edited as desired
    b. Click **Save**

Exporting Lists

The SWARM software compiles found signals into various lists. On the left side of the home screen is the Alarm Incident list. This contains signals that fall within the user-set parameters of potential threat devices. There are also comprehensive lists (both RF and WiFi) of found signals located at the bottom of the home screen. These can all be exported for further analysis or creating reports. For the purposes of this manual, the Alarm Incident List will be used as an example for exporting. Comprehensive RF and WiFi lists can also be exported in the same manner. To export the Alarm Incident List:

1) Under ***Incidents,*** select **Export**

2) In the pop-up that appears, type "**csv**" into the field that follows ***Output NULL values as:***
3) Leave defaults ***Full date/time (ISO)*** and leave unchecked the box following ***Include metadata file:***
4) Select **Export**



5) View the exported **.csv** file in a spreadsheet program such as MS Excel.

Appendix

System Requirements

Hardware

- MESA receivers
- Processing computer — SWARM requires a computer to run the back-end software (database, processing, analytics engine, and NTP time server)
    - Minimum system requirements:
        - Windows 10
        - Intel i5 or equivalent
        - 32 GB RAM
        - 500 GB disk space
        - 1440×900 graphic resolution
        - Gigabit Ethernet adapter
    - Recommended system configuration:
        - Intel i7 2.5 GHz or faster processor
        - 64 GB RAM
        - Nvidia 900/Radeon 400 series or equivalent with 4 GB VRAM

Software

SWARM has been tested on Windows 10/11 and requires Chrome (included).

Network

- **Gigabit Ethernet and switches**

Ports (TCP, except where noted)

Port	Purpose
3001	Message Server
3030	Activity Server Manager
3306	MySQL Database
4430	Web Server (HTTPS)
7000	License Server
7100	Sensor Status
8000	Web Server (HTTP)
8500	Spear Engine Interface
8586	SWARM Supervisor
9017	REST Server Node
9007	Spear Engine
20292	IRIS SCPI
30000 – 30099	Activity Service Client
43000	RRCP / MESA Control & Data (TCP) RRCP / MESA Autodiscover (UDP)

Specifications

SWARM MESA Kit

Case

Weight with contents	31 lbs. (14 kg)
Dimensions	21.96 x 13.97 x 8.98 in (55.8 x 35.5 x 22.8 cm)

Laptop

Lenovo ThinkPad P16s Gen3 (Intel)	
Battery	75Wh
Power Adapter	135W USB-C Slim (3-pin)
Dimensions (WxDxH)	14.24 x 9.97 x 0.83 in
Weight	4.01 lbs. (1.82 kg)
Operating System	Windows 11 Pro, English
Ports	1 x USB-A 1 x USB-A, Always On 2 x USB-C 1 x HDMI 1 x headphone/microphone 3.5 mm
Mil-Spec Test	MIL-STD-810 military test passed

MESA 2.0

See the included MESA 2.0 manual.

SWARM MESA Cable Kit

Case

Weight with contents	22 lbs. (10 kg)
Dimensions	21.96 x 13.97 x 8.98 in (55.8 x 35.5 x 22.8 cm)

Ethernet Switch

Gigabit Unmanaged Essentials Switch (NETGEAR)	
DC Input/Power In	12V / 0.5A
Power Consumption (Max and Standby)	3.04W/0.36W
Heat Dissipation (Max and Standby) (BTU/Hr)	10.40 BTU/1.06 BTU
10/100/1000Mbps Ports (Auto Uplink)	8
Form Factor	Desktop or wall-mountable
Bandwidth	16 Gbps

Ethernet Cables

Large Cable	Retractable Network Cable Extender (EXTINGO)
Length	50 ft (15.24 m)
Dimensions	3 x 5.1 x 6.5 in