Gladiator Forensics

GAR User's Guide

Front matter

Document information

Date: Thursday, February 8, 2024

Software version: 23.2

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Contents

1 Overview of the GAR

The Gladiator Autonomous Receiver (GAR) collects cellular coverage data remotely and autonomously for all cellular operators, technologies and frequency bands.

Cellular coverage data provides evidence of the whereabouts of a suspect or victim's cellular phone at a given time. It has been used as expert witness testimony in thousands of high profile cases.

Investigators can also use cellular coverage data to find missing persons, fugitives, bodies, and weapons, with greater accuracy than using call detail records and tower data alone.

The GAR unit is small and portable enough to be installed in a vehicle, boat, aircraft, all-terrain vehicle (ATV) or deployed on foot.

The GAR unit uploads the data into the One System Solution Enterprise Sensor Processing and Analytics (OSS-ESPA) application. OSS-ESPA analyzes call data records, tower data files, and cellular coverage data, and produces scientifically accurate tower coverage maps.

1.1 Features

The GAR unit supports multiple cellular technologies and frequency bands.

For further information, refer to **Specifications on page 95**.

The GAR unit has the following additional features:

- Portability: the GAR unit with suitcase is portable enough for personnel to conduct missions on foot and to travel with, both by car and commercial aircraft.

- Rugged construction: the GAR unit is built to high standards of vibration and shock specification.

- Hot-swappable batteries: change the batteries while the GAR unit is powered on.

- Intuitive and adaptable user interface: the GAR unit is operated through a browser-based interface, on a mobile device such as a tablet. Users can adapt the interface for their ease and convenience. The GAR unit displays collected data as easy-to-read maps, graphs or tables.

- Scanning of WiFi networks: the GAR unit scans WiFi networks in the following modes:

    - A/B/G/N/AC: the GAR unit scans WiFi 802.11 A/B/G/N/AC technologies with a sample rate of 2 seconds.

    - MIMO 2x2: the GAR unit scans WiFi 802.11 A/B/G/N technologies for MIMO 2x2 networks with a sample rate of 15 seconds.

    The GAR unit can identify the MAC addresses of stolen devices during collection.

The GAR unit is supplied with the following accessories:

- Power adapter and cable

- Radio frequency antenna

- GPS antenna

- Indoor WiFi antennas (optional)

- Outdoor magnetic WiFi antennas (optional)

1.2 OSS-ESPA cloud

After data has been collected with a GAR unit, it is uploaded to the One System Solution Enterprise Sensor Processing and Analytics (OSS-ESPA) application for analysis.

The GAR unit provides two options for upload of data to OSS-ESPA:

- Upload the data to OSS-ESPA as it is collected.

- Save the data to the GAR unit's disk and upload it later.

OSS-ESPA analyzes the data collected from a number of different GAR units, and outputs the results in the form of tables, maps and graphs.

If you set the GAR unit to upload continuously, you can access the OSS-ESPA application through your browser to see the data being analyzed and preview the results.

You can configure the GAR unit to automatically search for phones on a list of stolen devices while running a collection.

Upload a list of stolen devices to OSS-ESPA, and OSS-ESPA updates the GAR units automatically with the list. If the GAR unit detects a stolen device, it alerts the GAR user and flags the location of the device on the **Map** screen.

1.3 Drive tests

A drive test is the collection of cellular coverage data using the GAR unit as you cross the required search area on foot or by car.

- To start a campaign, run a collection in **Start a new collection and discovery (new campaign)** mode. This allows you to discover the operators, technologies, and frequencies in an area while collecting cellular coverage data.

- To run a collection as part of an existing campaign, run the drive test in **Start collection and discovery using last configuration**. This allows you to use the drive configuration of the previous collection, while also scanning for new operators, technologies, and frequencies and adding these to the configuration.

- To run a collection using only the operators, technologies, and frequencies discovered in the previous drive, run the drive test in **Start collection using last drive configuration**.

  To ensure that your collection data is accurate, run a new collection in **Start a new collection and discovery (new campaign)** mode each time you are collecting data in a new location. Do not use the drive configuration from a collection which is more than one month old.

- The GAR unit uploads the collected data to OSS-ESPA for analysis.

  Running collections as part of a campaign allows you to analyze the results in combination with the results of other collections in OSS-ESPA, to produce more detailed and accurate data.

  A campaign is a number of different collections of cellular coverage data over the course of several days, using the same drive configuration.

1.4 Notifications

The GAR unit uses a status icon in the GAR user interface to show the unit's receiver status.

- **Idle**

  No discovery or collection is running on the GAR unit.

  When you open the GAR user interface, the drive run wizard home page is displayed.

- **Collection**

  The GAR unit is running a cellular coverage data collection.

  When you open the GAR user interface, the **Map** screen is displayed.

- **Autonomous**

  The GAR unit is set to perform a discovery scan and a collection at the same time. It runs a collection on operators, technologies, and bands as soon as it identifies them.

  When you open the GAR user interface, the **Map** screen is displayed.

- **No RX Connection**

  This indicates that the GPS has frozen. To resolve this, check the integrity of your GPS antenna including the connection before restarting.

The GAR unit displays the navigation mode in the GAR user interface.

You can set the navigation mode to one of the following:

- **GPS**

- **Indoor**

- **Indoor+GPS**

For further information, refer to **Logs and Settings on page 92**.

1.5 Software overview

You can operate the GAR unit from a mobile device such as a tablet using the GAR user interface.

If the GAR unit is set to upload data continuously via MiFi, the mobile device connects locally to the unit allowing you to access the GAR unit through a browser on your device.

Remote access to the GAR unit requires a remote access license from Gladiator Forensics to allow access over a VPN connection.

1.6 About Gladiator Automated Target Acquisition (GATA)

GATA is a solution that integrates with a variety of Over-The-Air (OTA) equipment manufacturers and is designed to integrate real time call and location information from a variety of sources, such as T3, PRTT, GPS pings, GPS tracker, OTA truck location, into one screen while simultaneously configuring the OTA equipment automatically and seamlessly, creating optimal parameters to conduct a real-time tracking mission.

1.6.1 Key Features

- Provides a true one-screen solution for real-time tracking missions

- Integration of historical analysis, real-time intercept, and GPS data

- Displays OTA silent call response

- Notification when target device is on active voice or data session

- Target number identifier change detection and alert

- OTA GPS breadcrumb trail, target device RSSI, peak power location identification

- Ability to see the communications technology the target is using (2G, 3G, 4G, 5G or Wi-Fi)

- Visualization of neighboring cell sites

- Real time visualization of target phone location (cell site location/sector/azimuth, carrier GPS, handover events, location of OTA equipment, real-time RF survey data)

- Real-time blue force tracking

- Real-time public records search on all calls made or received

- Pattern of life analysis (best day/time for mission, idle times, first/last sectors, frequency by hour)
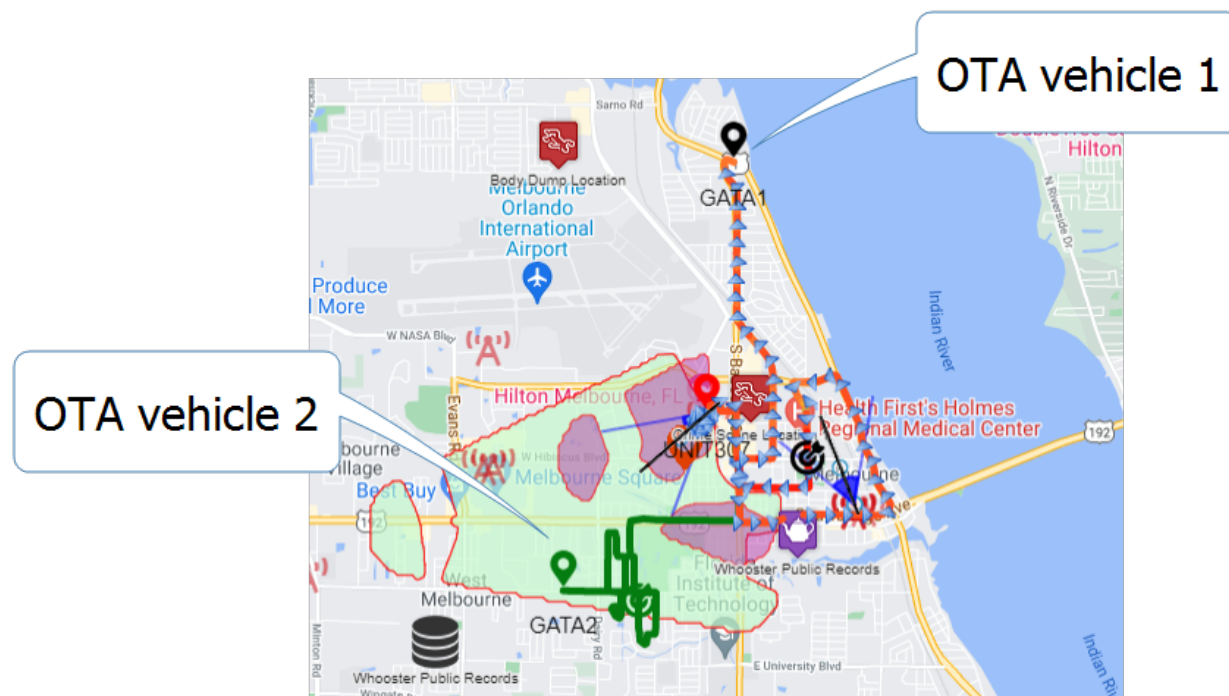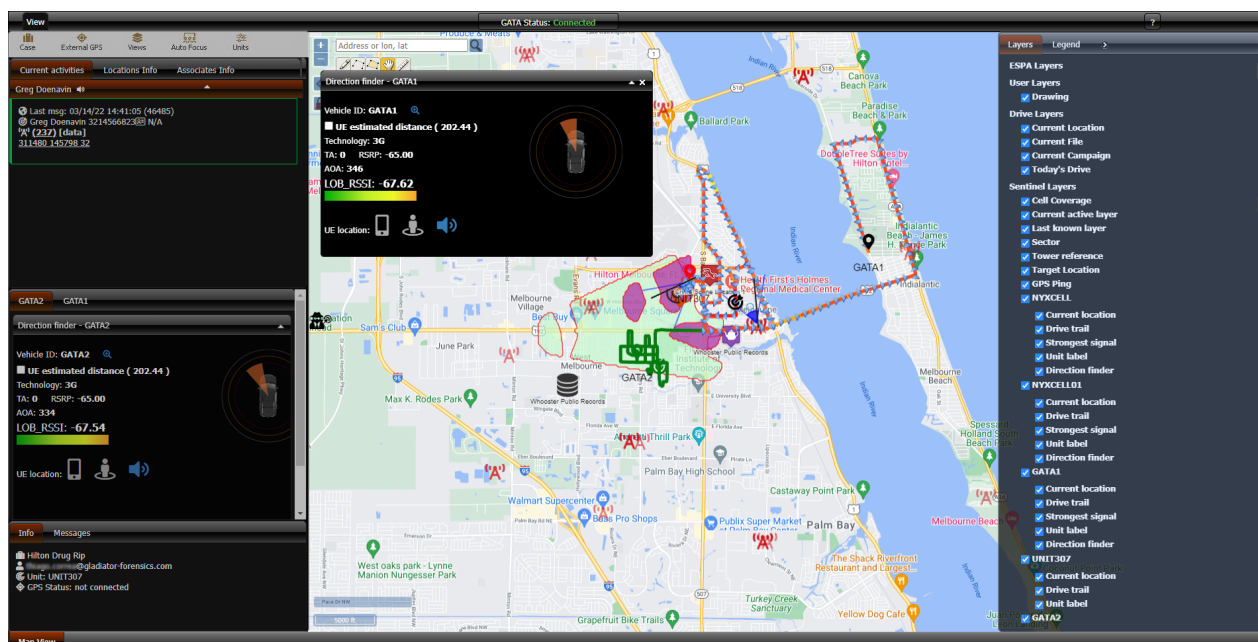
1.6.2 Key Benefits

- GATA is the only Over-The-Air (OTA) enhancement, designed to work with multiple OTA products, which is purpose built to monitor live data and configure the OTA equipment to the best parameters to locate the device

- GATA is designed to identify the new 5G Subscription Concealed Identifier (SUCI) and automatically update the OTA

  equipment configuration when a new one is generated

2 Operations

The GAR unit allows you to perform a range of operations to collect and manage drive data and run analyses, while GATA provides real-time tracking.

2.1 Collections and discoveries

The GAR unit allows you to perform a range of operations to collect and manage drive data.

2.1.1 Start a new collection and discovery (new campaign)

Using the GAR unit, you can start a collection while simultaneously running a discovery scan for new operators, technologies, and bands.

If you are starting a collection in a new city or location, then you should start a new campaign. This is so that the GAR unit can detect all the local channels in the new location.

If the distance between the locations of the previous drive and the new drive is greater than 50 kilometers (31 miles), then the GAR unit automatically starts a new campaign.

1. Power on the GAR unit, and connect to it using the tablet UI.

2. In the **Startup** tab's **Choose mode** screen, select **Start a new collection and discovery (new campaign)** and click **Next**.

   The **Startup** tab's **ESPA case info selection** screen opens.
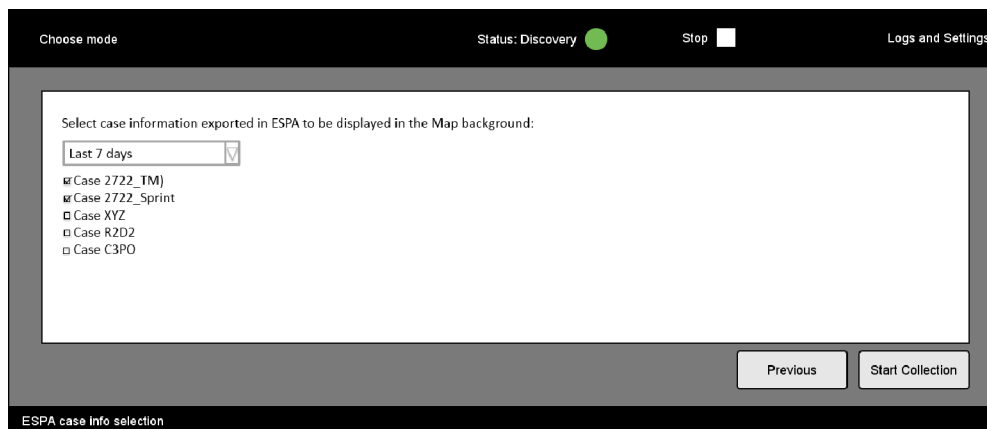
3. Use the drop-down and checkboxes to select any cases from which you would like to display information in the map layer of the

    collection results. Note, during a collection, if required this can be changed by clicking .

4. The GAR unit will stop searching for operators, technologies, and frequencies after the discovery duration timer expires.

    You can set the **Discovery Duration** timer in **Logs and Settings > Current configuration**. If the timer is set to `0`, the GAR
    unit runs the discovery scan continuously.

5. Click **Start Collection**.

    The GAR unit starts the collection with discovery.

2.1.2 Start a collection and discovery using the last drive configuration

Using the GAR unit, you can use the results of the previous drive configuration to run a cellular coverage data collection. In this mode the previous discovery is used and only new channels that are discovered are configured. The drive trail breadcrumbs of the previous drive are also displayed on the map.

As it runs the collection, the GAR unit continues to scan for new operators, technologies, and bands and includes them in the collection.

1. Power on the GAR unit, and connect to it using the tablet UI.

2. In the **Startup** tab's **Choose mode** screen, select **Start collection and discovery using last drive configuration** and click **Next**.

    The **Startup** tab's **ESPA case info selection** screen opens.

3.   Use the drop-down and checkboxes to select any cases from which you would like to display information in the map layer of the

collection results. Note, during a collection, if required this can be changed by clicking .

4.   The GAR unit will stop searching for operators, technologies, and frequencies after the discovery duration timer expires.

You can set the **Discovery Duration** timer in **Logs and Settings > Current configuration**. If the timer is set to 0, the GAR
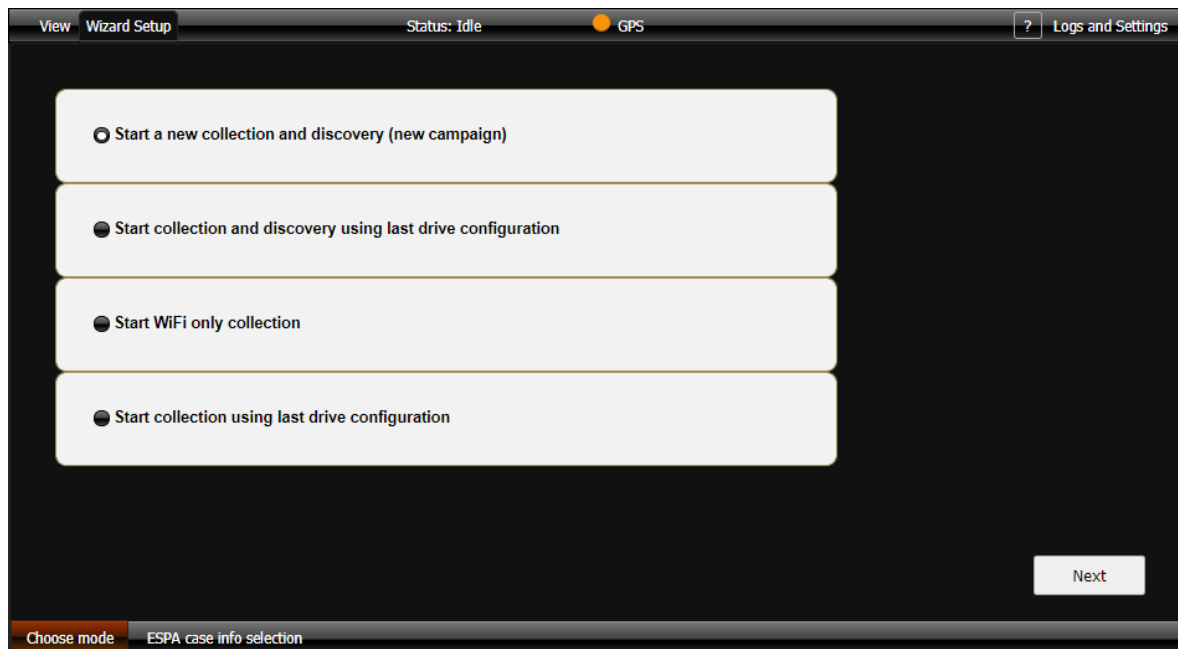unit runs the discovery scan continuously.

5.   Click **Start Collection**.

The GAR unit starts the collection with discovery.

2.1.3 Start WiFi only collection

Select to run a WiFi only collection, if you are only interested in collecting information about detected WiFi-enabled devices, for example cell phones and laptops, which are connected to a wireless access point.

1. Power on the GAR unit, and connect to it using the tablet UI.

2. In the **Startup** tab's **Choose mode** screen, select **Start WiFi only collection** and click **Next**.

    The **Startup** tab's **ESPA case info selection** screen opens.

3. Use the drop-down and checkboxes to select any cases from which you would like to display information in the map layer of the collection results. Note, during a collection, if required this can be changed by clicking .

4. The GAR unit will stop searching for operators, technologies, and frequencies after the discovery duration timer expires.

    You can set the **Discovery Duration** timer in **Logs and Settings > Current configuration**. If the timer is set to 0, the GAR unit runs the discovery scan continuously.
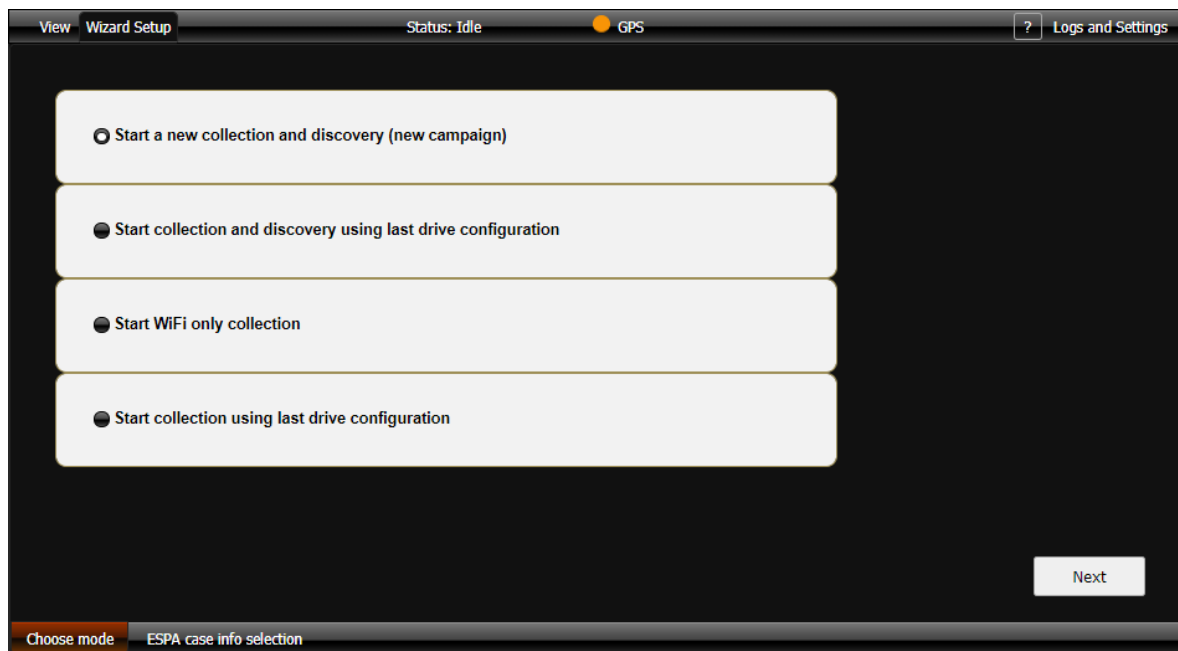
5. Click **Start Collection**.

    The GAR unit starts the collection with discovery.

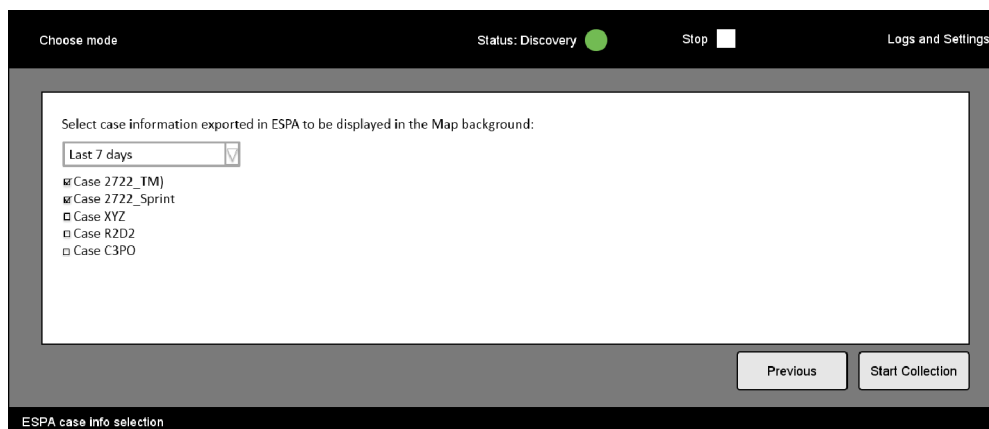## 2.1.4 Start a collection using the last drive configuration

The GAR unit allows you to use the results of a previous drive configuration to run a cellular coverage data collection.

1. Power on the GAR unit, and connect to it using the tablet UI.

2. In the **Startup** tab's **Choose mode** screen, select **Start collection using last drive configuration** and click **Next**.

    The **Startup** tab's **ESPA case info selection** screen opens.
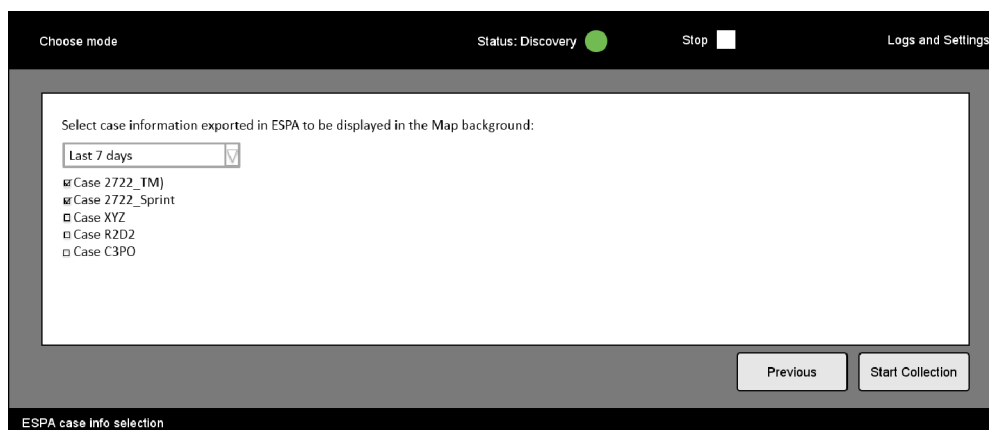
3. Use the drop-down and checkboxes to select any cases from which you would like to display information in the map layer of the

    collection results. Note, during a collection, if required this can be changed by clicking .

4.   Click **Start Collection**.

     The GAR unit starts the collection.

2.1.5 Switch between GPS and indoor collection

If you are running a collection in a location and the GAR unit no longer receives a GPS signal, you can manually enter the coordinates of one or more locations on your collection route. This allows the GAR unit to keep recording location information with the collection data.

For example, you might need to switch between **Indoor** and **GPS** navigation modes if you are running a walk-test in a building with open-air areas, such as a sports stadium or shopping concourse.

1. Power on the GAR unit, and connect to it using the tablet UI.
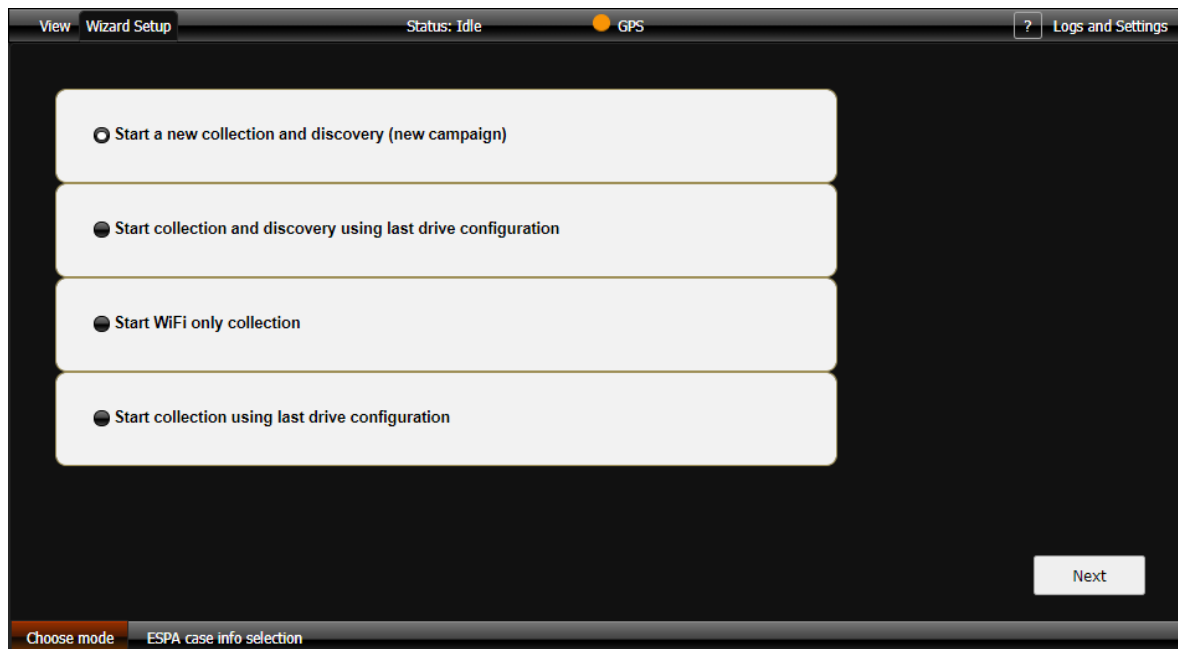
2. For an indoor collection, while in Idle status, navigate to **Logs and Settings > Current configuration**.

    Note, if you are not in Idle status, click **Stop** at the top of the screen.

3. Change the **Navigation mode** to **Indoor+GPS**, then click **Save settings**.

4. Click the **View** tab, select **Map**, then select the **Indoor** or **GPS** options as required for the collection, using the ⍟ and ⍟ toggle buttons respectively.

5. Enter the coordinates of a location on your collection route by clicking the location on the map.

    The **Update coordinates** dialog opens.

6. If necessary, change the **Latitude** and **Longitude** in the dialog.

7. In the **Alias** field, enter a term which describes the data you collect at these coordinates, for example `First_floor`. Click **Update**.

The GAR unit updates your indoor location with these coordinates. The GAR unit also creates a new file, using the Alias as the filename, and saves the data you collect in this file.

8.   Repeat steo 5, step 6 and step 7 to record multiple indoor locations and floors as you move around during the indoor collection.

2.1.6 Review collection information

You can review the results of a cellular coverage data collection as the data is being collected.

The **View** tab allows you to select six different screens, which displays the collection data in the following formats:

- **Map**: displays a map of the search area. Use this screen, for example, to see the collection route and the case data location, to be sure you are collecting data in the right location.

- **Graph**: displays a graph showing the signal strengths of the frequencies being scanned. By default the overview is displayed.

  The **Graph** screen also displays graphs of the results of specific operators, technologies, and bands. Access these options using from the icon in the upper left corner.

- **Grid**: displays a table of all the bands for which the collection scans, with their associated operators and technologies.

  Use this, for example, to see an overview of all the data being collected.

- **Network Info**: displays data and decoded messages for which the source has been identified

  For further information, refer to **Network Info on page 87**.

- **Device info**: allows you to view the results of detected WiFi-enabled devices.

  For further information, refer to **Device Info on page 88**.

- **Summary**: this screen opens when the collection is finished.

  For further information, refer to **Summary screen on page 91**.

2.2 Run an analysis

The GAR unit allows you to run different types of analyses on the cellular coverage data gathered during a collection drive or a discovery scan.

2.2.1 MCLA

Using the GAR unit, you can run an MCLA (Most Common Least Attractive) analysis to collect cellular coverage data and determine the best possible configuration to use when setting up a Base Station Emulator.

An MCLA analysis searches the neighbor list of all the serving cells in the required area for the most common channels or codes broadcast, and identifies the channel or code with the lowest signal level.

1. On the **Map** screen, use the drawing tools to draw a polygon, and save it to the GAR unit.

   The polygon indicates the area to be analyzed. This area can be up to 200 square miles in size.

2. Ensure that the GAR unit is in **Idle** mode.

   If the GAR unit is in **Collection** or **Autonomous** mode, click **Stop** which is displayed at the top of all screens.

3. Click to configure options for an MCLA analysis.

   The **Most Common Least Attractive Analysis** pop-up is displayed.

4. Select one or more of the following input criteria:

   - **Use polygon boundary**: select a saved polygon

   - **Use timespan**: define Start and End times

   - By default, MCLA uses the campaign dates and collection times.

   - **Limit operators**: Specify operators to include in the analysis, excluding all others

   - **Limit technologies**: Specify technologies to include in the analysis, excluding all others

   By default, MCLA analyzes all operators and frequencies.

   > CAUTION: If you do not limit the operators or technologies, this default MCLA analysis takes a long time to run.

5. Click **Run**.

   The MCLA analysis is queued in the **Analysis** screen.

   When the analysis is complete, click **Show** to view the results.

6. Click to export the data in a .csv format.

   You can access previous MCLA analyses from the **Analysis** screen.

For further information, refer to **Analysis on page 90**.

2.2.2 Base Station Location

If you do not know the location of cell towers in the area, you can run a GAR base station analysis to estimate the location of a base station broadcasting a specific signal.

1. On the **Map** screen, click .

   The **Base Station Analysis** pop-up is displayed.

2. Select one or both of the following input criteria:

   - **Operators**: Specify operators to include in the analysis, excluding all others.

   - **Technologies**: Specify technologies to include in the analysis, excluding all others

   By default, the GAR unit performs a base station analysis using all operators and technologies.

3. Click **Run**.

   The base station location analysis is queued in the **Analysis** screen.

The analysis runs in real time . As the GAR unit runs the analysis, it displays the located Base Stations on the **Map** screen. The GAR unit updates the locations as it receives more data.

You can save the analysis result and reopen it later. You can access previous Base Station Location analyses from the **Analysis** screen.

For further information, refer to **Analysis on page 90**.

2.2.3 Snapshot analysis

If you want to identify which cell towers are in a specific area, you can run a GAR snapshot analysis to identify them.

1. On the **Map** screen, click .

   The **Snapshot type** pop-up is displayed.

2. Select either:

   - **Current Location**: select if you want the map's current central location used as latitude and longitude for the snapshot analysis.

   - **File**: select if you want to select specific GAR data files to be used for the snapshot analysis.

3. In **Location Name** enter a name for the snapshot analysis.

4. In **Period** select the time period over which you want the snapshot analysis performed. You can either select from a variety of predefined ranges, such as the last 12 hours, or select **custom** which allows you to specify a **Start** and **End** date.

5. In **Buffer** enter the distance around the location that you want analyzed.

6. Select one or both of the following input criteria:

- **Operators**: Specify operators to include in the analysis, excluding all others.

- **Technologies**: Specify technologies to include in the analysis, excluding all others

By default, the GAR unit performs a snapshot analysis using all operators and technologies.

7. Click **Run**.

The snapshot analysis is queued on the **Analysis** screen.

8. You can view the results on the **Analysis** screen once the **Progress column** displays `Execution is finished`. To view the result, click **Show**. The results open on a new browser tab.

Examples of the results screen are shown below: In the results you can:

- Click **Export csv file** to export the results for use elsewhere.
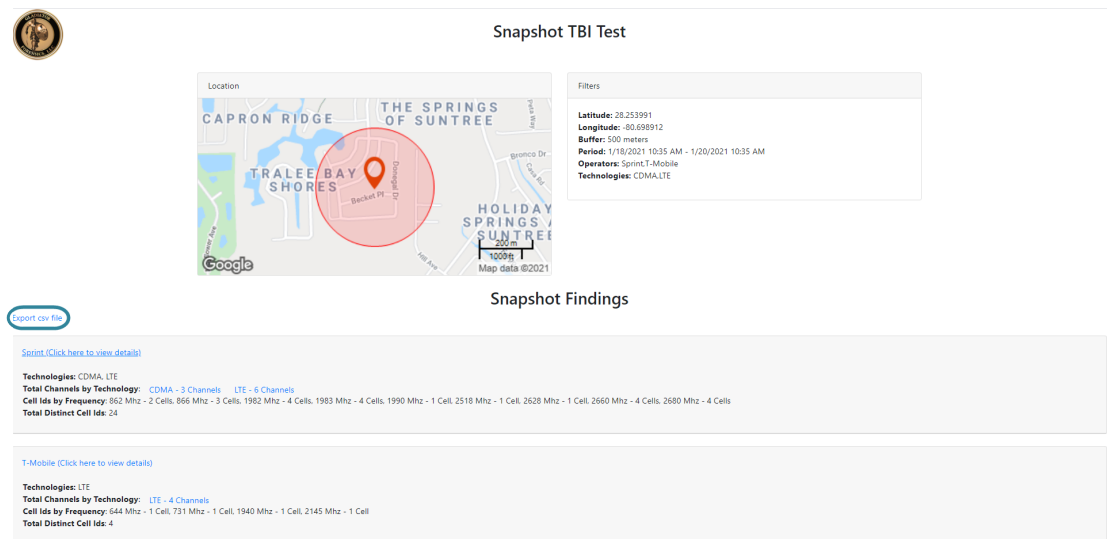
- Click the operator link to expand the results and view the detail in a tabular format. This table also allows you to view the neighboring cells.

Snapshot Findings

Export csv file

Sprint (Click here to view details)

Technologies: CDMA, LTE
Total Channels by Technology: CDMA - 3 Channels   LTE - 6 Channels
Cell Ids by Frequency: 862 Mhz - 2 Cells, 866 Mhz - 3 Cells, 1982 Mhz - 4 Cells, 1983 Mhz - 4 Cells, 1990 Mhz - 1 Cell, 2518 Mhz - 1 Cell, 2628 Mhz - 1 Cell, 2660 Mhz - 4 Cells, 2680 Mhz - 4 Cells
Total Distinct Cell Ids: 24

Operator	Technology	Frequency	Channel	Cell ID	Code	TAC	LAC	Neighbors	Min Quality	Avg Quality	Max Quality	Std. Dev Quality	Min Power	Avg Power	Max Power	Std.Dev Power	Samples
Sprint	CDMA	862 Mhz	476	2557	237	N/A	N/A	view	-11.50	-8.32	-6.49	0.83	-86.13	-83.65	-82.07	0.72	2747

Neighbor Technology		Neighbor Id	Type	Neighbor 1	Neighbor 2	Neighbor 3	Neighbor 4	Neighbor 5	Neighbor 6	Neighbor 7	Neighbor 8	Neighbor 9	Neighbor 10	
CDMA		476	Intra	240	243	9	117	30	291	114	36	348	213	

Operator	Technology	Frequency	Channel	Cell ID	Code	TAC	LAC	Neighbors	Min Quality	Avg Quality	Max Quality	Std. Dev Quality	Min Power	Avg Power	Max Power	Std.Dev Power	Samples
Sprint	CDMA	862 Mhz	476	2556	117	N/A	N/A	view	-19.92	-13.18	-9.99	1.26	-94.20	-88.44	-85.48	1.22	8237
Sprint	CDMA	862 Mhz	476	2556	111	N/A	N/A	view	-19.92	-13.18	-9.99	1.26	-94.20	-88.44	-85.48	1.22	8237
Sprint	LTE	866 Mhz	8763	99147803	282	33842	N/A	view	-18.88	-17.72	-17.16	0.31	-102.73	-101.46	-100.79	0.40	2118
Sprint	LTE	866 Mhz	8763	99147801	251	33842	N/A	view	-18.16	-17.83	-17.49	0.20	-102.21	-101.66	-101.10	0.32	846
Sprint	LTE	866 Mhz	8763	99160601	97	33842	N/A	view	-20.53	-19.81	-18.45	0.38	-104.09	-103.60	-102.53	0.28	2154
Sprint	CDMA	1982 Mhz	1050	3556	117	N/A	N/A	view	-37.27	-15.28	-6.80	4.21	-127.58	-103.32	-94.92	4.53	15780
Sprint	CDMA	1982 Mhz	1050	3557	237	N/A	N/A	view	-37.99	-15.36	-6.28	4.58	-125.82	-103.43	-93.32	4.48	4388
Sprint	CDMA	1982 Mhz	1050	3556	111	N/A	N/A	view	-37.27	-15.28	-6.80	4.21	-127.58	-103.32	-94.92	4.53	15780
Sprint	CDMA	1982 Mhz	1050	3554	30	N/A	N/A	view	-36.43	-17.45	-10.33	3.95	-125.09	-105.48	-98.00	3.81	2322
Sprint	CDMA	1982 Mhz	1050	3562	348	N/A	N/A		-35.11	-18.77	-10.87	3.72	-121.08	-107.13	-101.55	3.13	404
Sprint	CDMA	1983 Mhz	1075	3556	117	N/A	N/A		-15.51	-11.21	-9.06	2.43	-105.28	-101.49	-99.19	2.14	13304
Sprint	CDMA	1983 Mhz	1075	3554	30	N/A	N/A	view	-37.48	-18.52	-9.38	4.88	-127.01	-107.91	-98.15	4.81	3473
Sprint	CDMA	1983 Mhz	1075	3556	111	N/A	N/A	view	-15.51	-11.21	-9.06	2.43	-105.28	-101.49	-99.19	2.14	13304

- Hover over the total channels per technology to view the frequency channels.

Snapshot analyses are also automatically exported to ESPA, where you can review them on ESPA's **Analysis center** screen. For further information refer to the OSS-ESPA Help.

## 2.2.4 Plotting collected cell coverage data on the map

The Cell coverage analysis allows you to plot cell coverage data on the map. You can choose which data you want to plot. You can select the data collection files you want to use and which operators and technologies. You can then choose the cells you want to plot, and whether the data you plot is based on cell id, quality or power.

1. On the **Map** screen, click .

   The **Cell coverage** pop-up is displayed.

2. On the **Data selection** tab you must select the cell coverage data you want to display.

    a. In **Period** select the time period for the drives that you want to display the cell coverage of. This filters the drive data files that are displayed in **Files**.

        You can either select from a variety of predefined ranges, such as the last 12 hours, or select **custom** which allows you to specify a **Start** and **End** date.

    b. In **Files** select the drive data files of interest.

    c. In **Operators** and **Technologies** select those that are of interest.

    d. Click **Data Plot** to display the cell coverage data on the map.

3. How the cell coverage data is plotted depends on what you have configured on the **Data Plot** tab. If you want to display the data differently, click the **Data Plot** tab.

    a. In **Plot Settings**, select:

        • By Quality

        • By Cell ID

        • By Power

    b. In **Signal Strength**, select the number of servers you want the data displayed for depending on their strength.

    c. Select **GPS Trail** if you want the drive route displayed.

    d. Click **Refresh** to update the plotted cell coverage data.

4. If you would like the cell coverage legend displayed on the map in your preferred location then click **Legend** and drag it from the **Cell coverage** dialog box and drop it in your preferred location.

5. You can also use the cell coverage legend to change the color, opacity and size used to plot the data on the map. To do this click the cell color circle in the **Legend** to open the **Cell settings** dialog box. This dialog also allows you to apply the opacity and size to all.
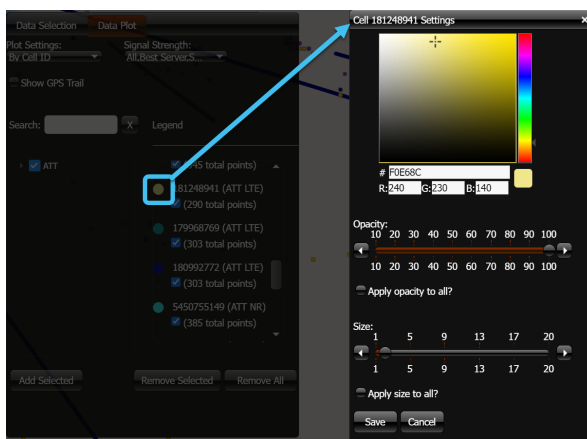
2.3 Select elements to surveil

The GAR unit allows you to select cells and WiFi networks to monitor in real time.

The GAR unit displays information collected about elements under surveillance on the **Network info** screen, and on the **Map** screen. This makes it easier for you to monitor information and keep track of element location.

The GAR unit displays additional information collected about devices under surveillance in the **Device Info** screen.

1. Click the **View** tab and select the **Network Info** screen.

   The Selection panel displays the available cells and WiFi networks in a tree view of operator, technology, frequency, channel, and cell.

   For further information, refer to **Network Info on page 87**.

2. Click to select the time-frame in which data about the element was first collected by the GAR unit.

3. To select an element from the tree view, navigate the tree in the Selection panel and select the check box for the required element.

   The element is added to the **Selected** tab of the **Surveilled elements** panel.

4. Specify an additional element to surveil:

   - To specify an additional cell, select **Cellular** and choose the operator from the drop-down.

   - To specify an additional WiFi network, select **Wifi** and choose the required band from the drop-down.

   The element is added to the **Selected** tab of the **Surveilled elements** panel, and displayed in a layer on the **Map** screen.

5. To configure the GAR unit to search for elements matching specified criteria, click .

   The **Surveilled elements** input dialog opens.

   - To enter search criteria for a cell from an OSS-ESPA case, select **Cellular - Espa Case Inputs** then select the OSS-ESPA case.

   - To enter search criteria for a cell manually, select **Cellular - User Inputs** and use the drop-downs and fields.

   - To enter search criteria for a WiFi network manually, select **Wifi - User Inputs** and use the drop-downs and fields.

6. Click **OK**.

   Any element which matches the search criteria is added to the **Search** tab of the **Surveilled elements** panel, and displayed in a layer on the **Map** screen.

7. To delete elements from the tabs in the **Surveilled elements** panel, do one of the following:

- To delete a single element, select the element then click .

- To delete all elements, click .

The GAR unit automatically searches for devices which match the list of stolen devices from OSS-ESPA, and displays these in the **Stolen devices** tab of the **Surveilled elements** panel.

For further information, refer to **OSS-ESPA cloud on page 3**.

2.4 Assigning GAR to the WiFi network for the first time

1.   Disconnect the network cable shown below, then connect a network cable from this port to your computer.
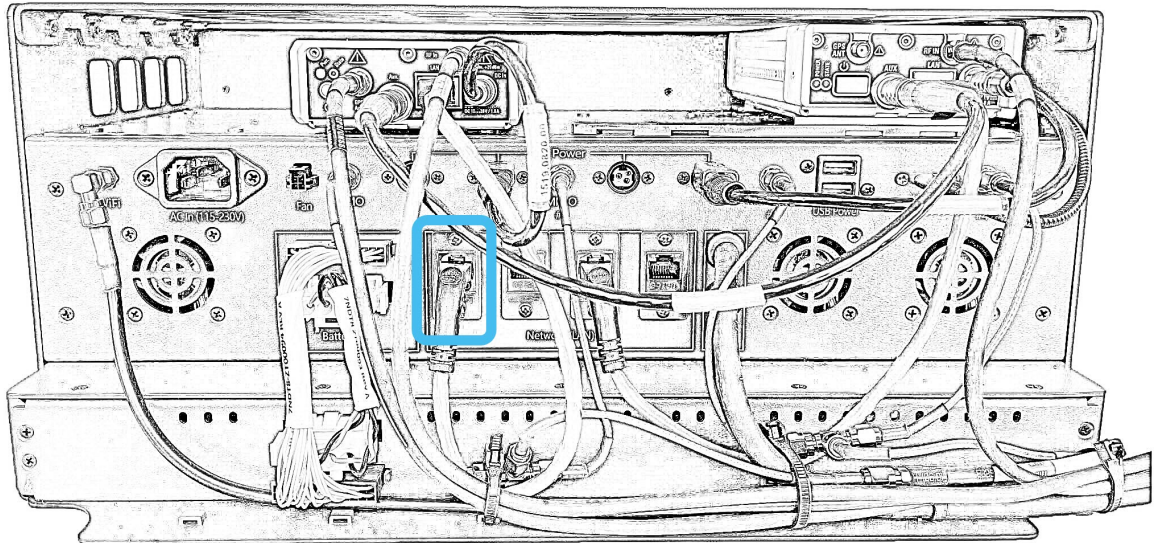
2.   On your computer, open the **Network Connections** window and assign the local IP address for the port you are connected to.
     To do this:

     a.   In the **Wi-Fi Properties** dialog box, highlight **Internet Protocol Version 4 (TCP/IPv4)**, then click **Properties**.

          The **Internet Protocol Version 4 (TCP/IPv4)** dialog box opens.

     b.   Select **Use the following IP address**, then in **IP address** enter the address for the port you connected to which is

192.168.20.20.
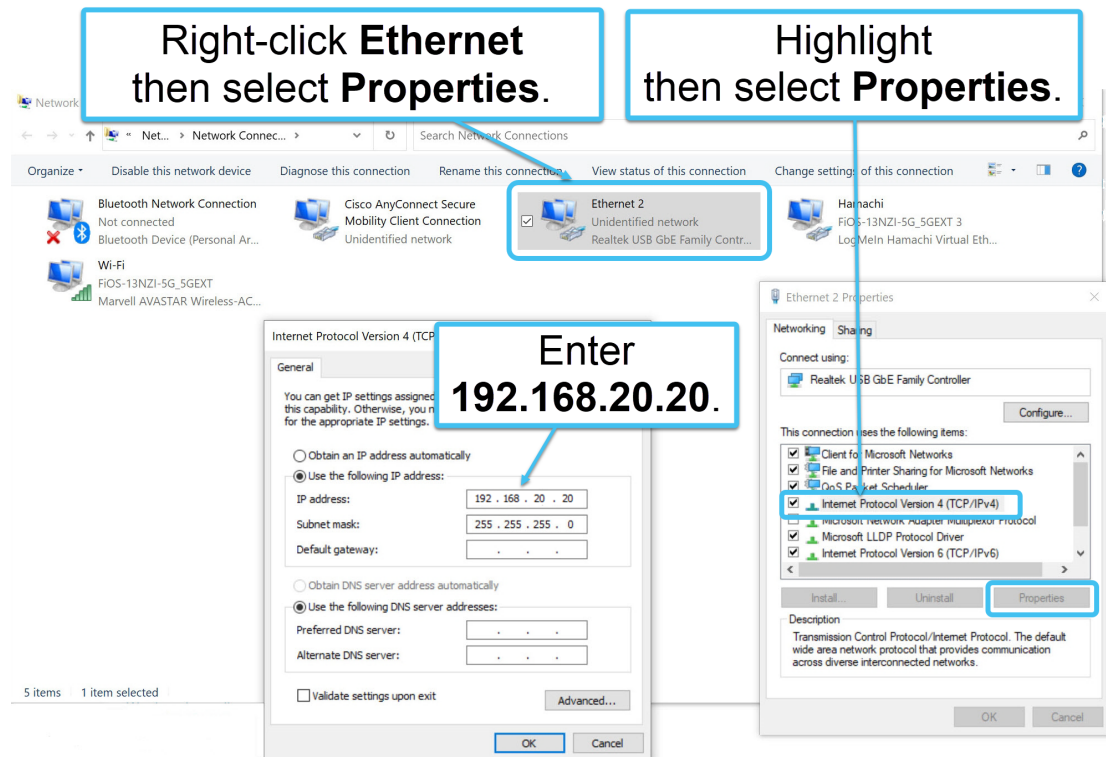
3.   On your computer, open the **Remote Desktop Connection**.

    a.   In **Computer** enter **192.168.20.1**.

    b.   In **User name** enter **Gar**, and for the password enter **gar**. You can select to save the connection so that you do not need to enter the these details in the future.
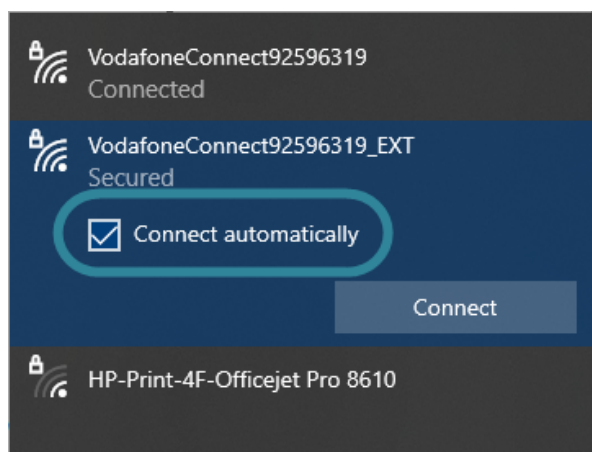
c. Click **Connect**.
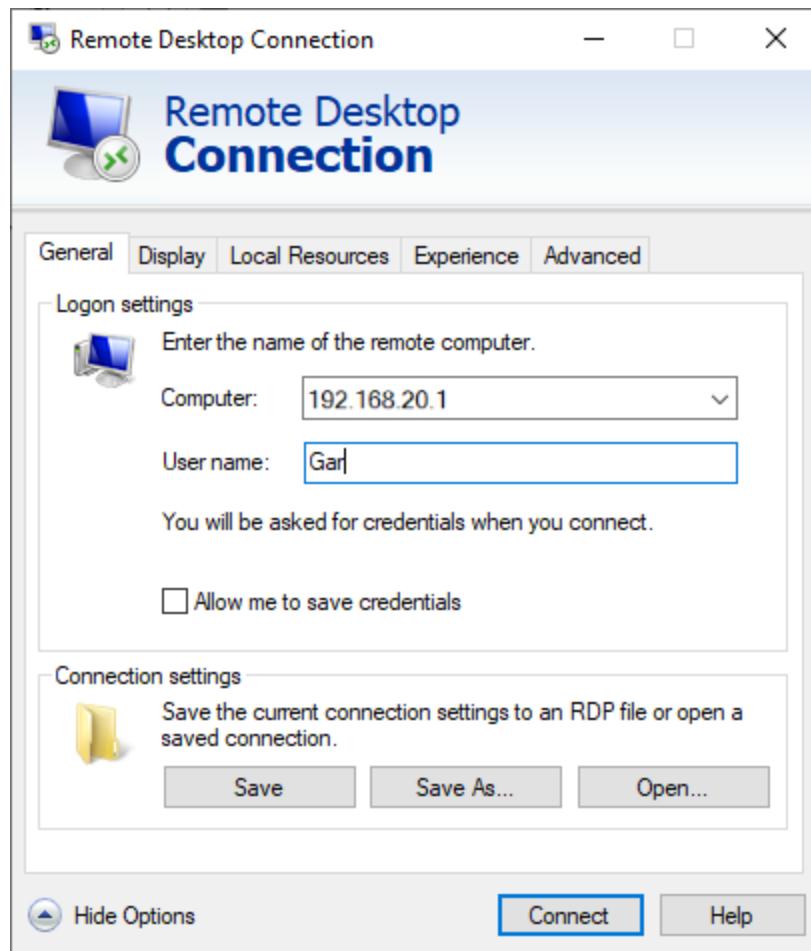
4. Once logged into your GAR unit click on your computer's taskbar to assign the Wi-Fi Network.

Ensure you select **Connect Automatically** so that in the future when your GAR unit is powered on it automatically connects to this network if available.
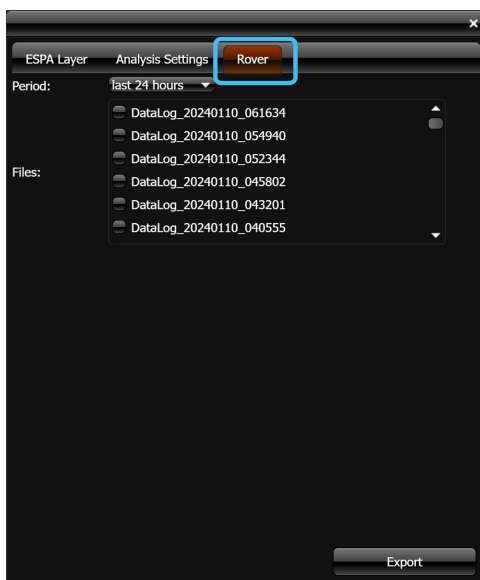
2.5 Exporting GAR files to an external tool

This topic explains how to export your GAR unit's .gtz files to use in an external tool. It also explains how to cancel, delete and view the status of an export request.
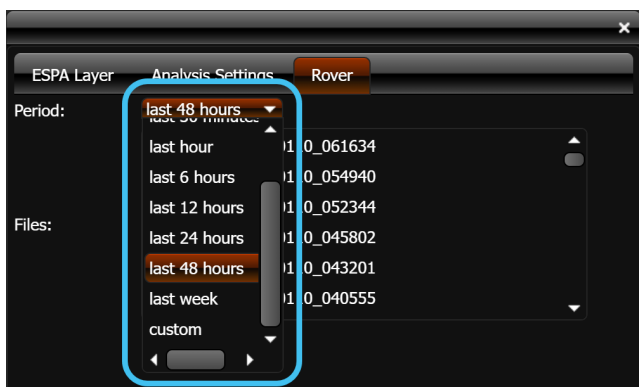
1. On the **Map View**, click on the right of the map.
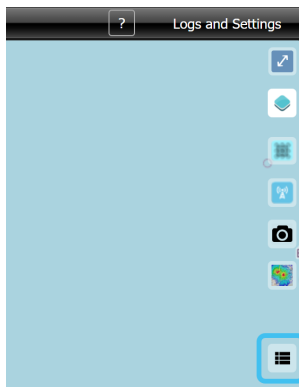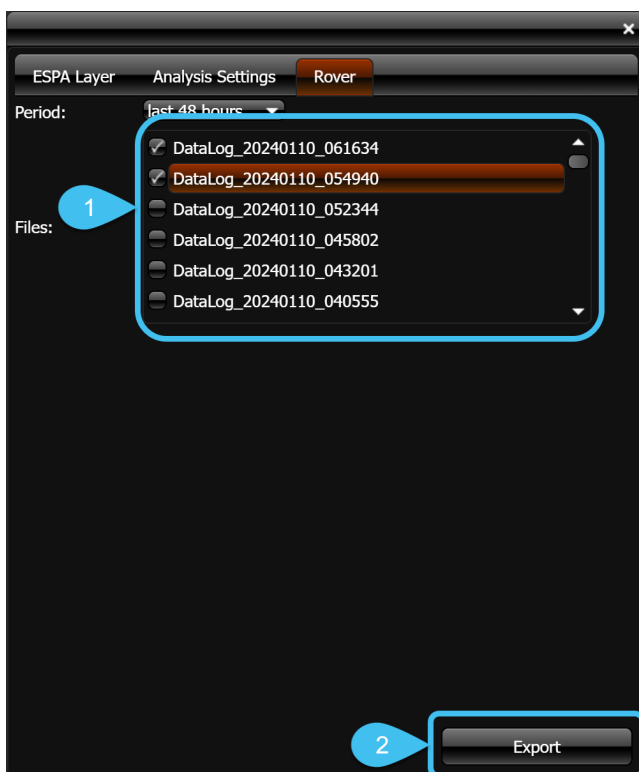

2. Click to open the **Rover** tab.

3. In **Period**, select the time range in which the drive was performed. This filters the results that are displayed in **Files**, making it easier for you to locate the files you want to export.
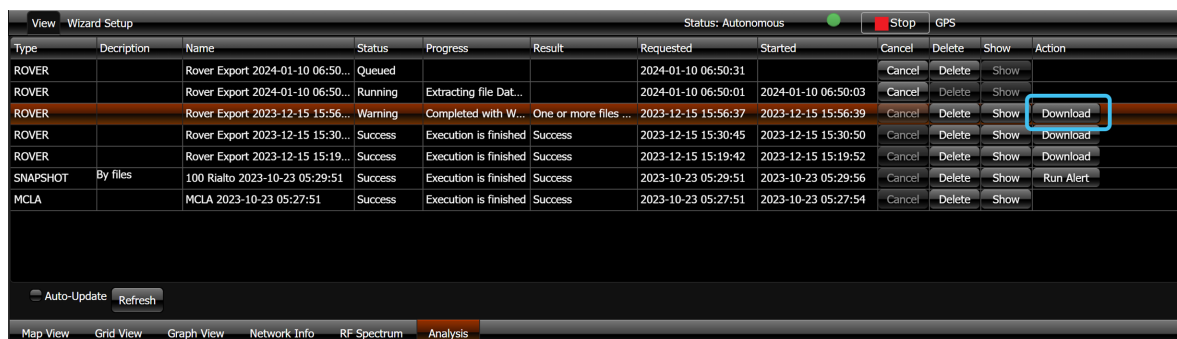

4. In **Files**, use the check-boxes to select which files you want to export, click **Export**, then click **OK**.

5. Click the **Analysis** tab at the bottom of the map to download and manage the export.
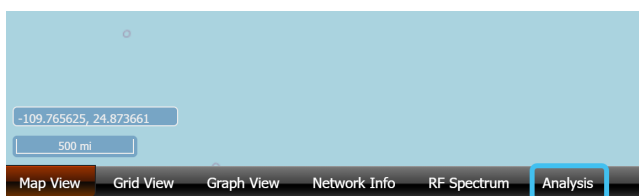
6. On the **Analysis** tab, the **Type** column displays as **ROVER** for an export. Click **Download** to export the file, which you can then import into an external tool.

Note, the export also has three other buttons:

- **Cancel**: this is only applicable when the export is running. Click to cancel your export request.

- **Delete**: this is only applicable when the export has finished running. Click to delete the export.

- **Show**: click to open a tab titled **Rover Export <date/time of export>**, as shown below, that allows you to view the status of all the files you selected to export.
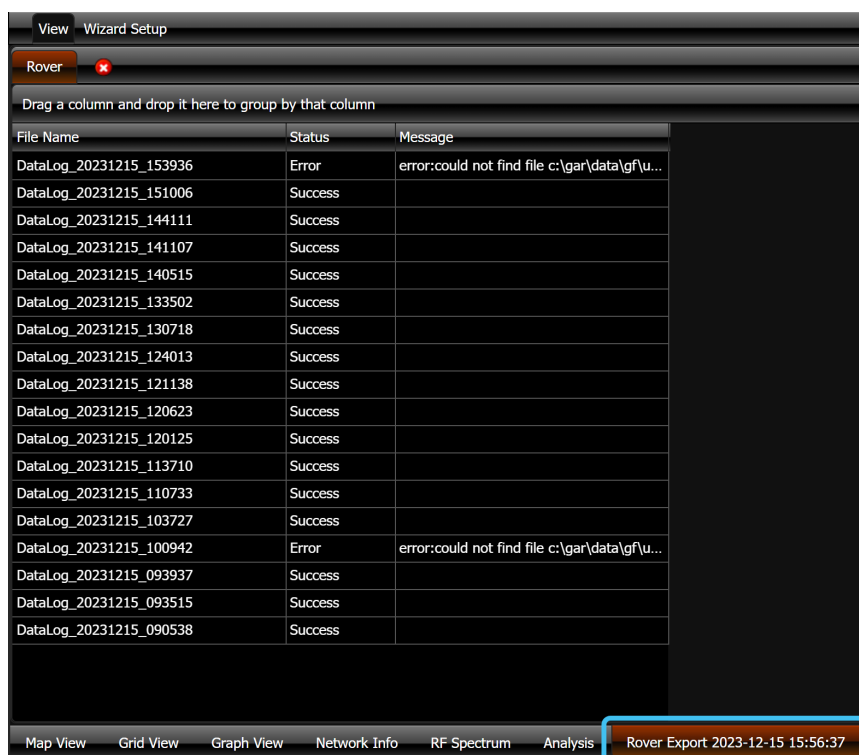
2.6 Using GATA

This book describes how to use GATA for real-time tracking. It explains how to synchronize with OSS-ESPA so that you receive the active and historical trails, and the active calls for your case of interest. It then describes how to use the map features to locate a device.

If you are using a GAR or GATA unit, then your location is automatically sent to OSS-ESPA. However if you are not using a GAR or GATA unit and want to let OSS-ESPA know your location then this book explains how to do that via an external GPS device.
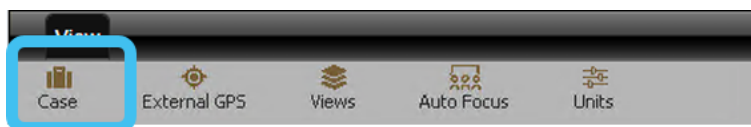
2.6.1 Monitoring movement on the Map View

This topic describes how to use the **Map View** to monitor the ongoing communications and movement of a target device. Prior to monitoring a target device you must have created a case in OSS-ESPA.
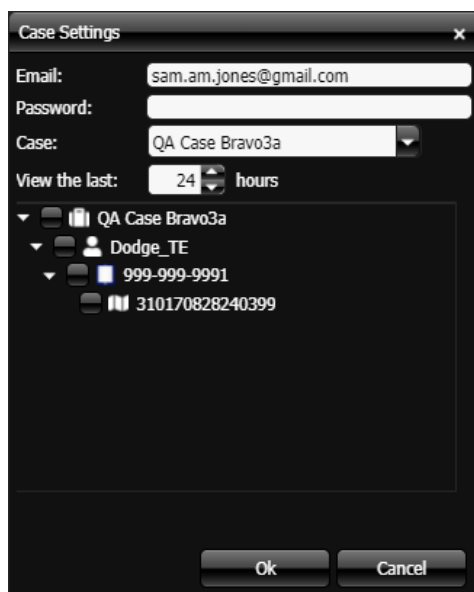
1. On the **Map View**, click on the left of the map.

   The **GATA** panel opens.

2. Click .

   The **Case Settings** dialog box opens.

3.   On the **Case settings** dialog box:

   a.   If this is the first time you have signed in, or another user is currently signed in, then in **Email** and **Password** you must
        enter your OSS-ESPA account details, then click **OK**.

   b.   The software is reloaded and on returning to this dialog box your cases are automatically listed in **Cases**.

   c.   In **Case**, select the case you want to monitor. You can either select your case from the drop-down list or start typing the
        case name to display it.

   d.   In **View the last**, enter the time period over which you want to view the active and historical trails, and the active calls.

   e.   In the list of people and phones, ensure all the CASEIDs (LIIDs) (lawful interception identifiers) you want to monitor are
        selected.

   f.   Click **OK**.

        The software is reloaded and synchronizes the case data with OSS-ESPA.

4.   The map now displays active and historical trails, and active calls for the time period you selected. You can now monitor the
     movements of the target device on the map as new communications arrive, and view the field unit trails of yourself and your
     colleagues.

   •   All active calls are listed on the **Current activities** tab. Typically these activities are outlined with a green box to
       indicate they are active. When an activity ends it remains on this tab for ten seconds and is displayed with a red outline.
       You can click the tower reference number to center the cell tower's location on the map. To investigate the location
       further you can click the cell identifier to open the location on a separate browser tab in Google Maps.

- The ten last known associates and locations are listed on the **Associates Info** and **Locations Info** tabs. You can click the date/time link to center the cell tower's location on the map. To investigate the location further you can click the cell identifier to open the location on a separate browser tab in Google Maps. You can use the icons on these tabs to filter what is displayed. For example, you can display all used sectors, GPS ping locations and cell coverage on the map
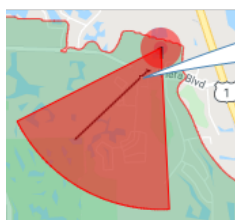
Locations Info tab:
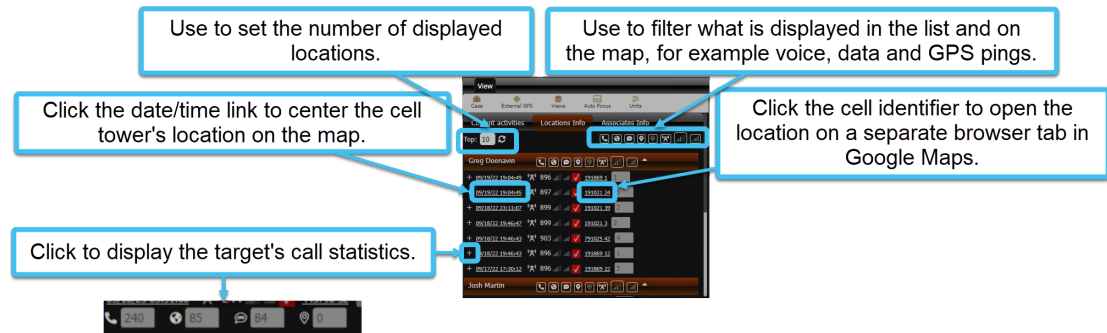

Associates Info tab:
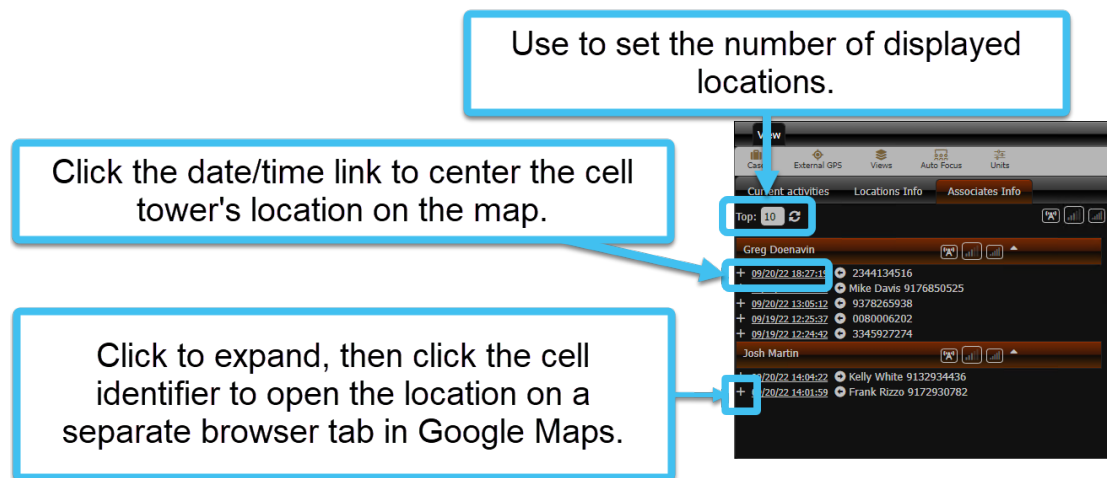
- The person's last known call location is marked with a moving straight line. If the most recent location is a sector with no azimuth defined then this straight line is displayed moving over 360 degrees. The last known GPS ping location is displayed as a circle with radiating lines above and below.

This straight moving line indicates that this is the last known location. As there are no additional curved lines radiating from it the call is no longer in progress.

- The person's current activities are marked with moving curved lines. If the current activity locations is a sector with no azimuth defined then these curved lines are displayed over 360 degrees.
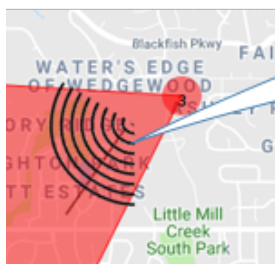
These moving curved lines indicate that there is current activity at this location.

Current activities are defined as:

- a call or data session in progress. Note, that the map displays all the sectors that have been used during the call, not just the call's latest sector. The sector that is currently being used is displayed with moving curved lines, whereas the previous sectors show no moving curved lines.

- an SMS that occurred in the previous 60 seconds.

- GPS pings that occurred in the previous 60 seconds.

- A ⌂ 🔔 1 notification appears automatically if there is any change to a device's subscriber information (IMSI, MSISDN, SUPI-IMSI, GPSI-MSISDN, SUCI, GUTI-5G) and the device information (IMEI, IMEISV, PEI-IMEI, PEI-IMEISV). This type of alert notifies you of pertinent changes related to the target device which may require you to reconfigure other mission equipment in order to accomplish your mission.

The subscriber information can change when the target changes the SIM card or any temporary identifier related to the SIM card managed by the operator. The most current IMSI, GUTI or SUCI (5G) number is required if you want to locate the phone with cell tracking equipment.

The device information is related to the phone model or device in use with the subscriber identifier, and is required to configure the cell tracking equipment with regards to the device's supported technologies and limitations.

When you click the notification, it opens the **Notifications** pop-up which displays the most recent changes. Click **View history** if you want to view any previous changes. Click **Dismiss all** to remove the alert notification from the screen and to also clear the historical alarms.
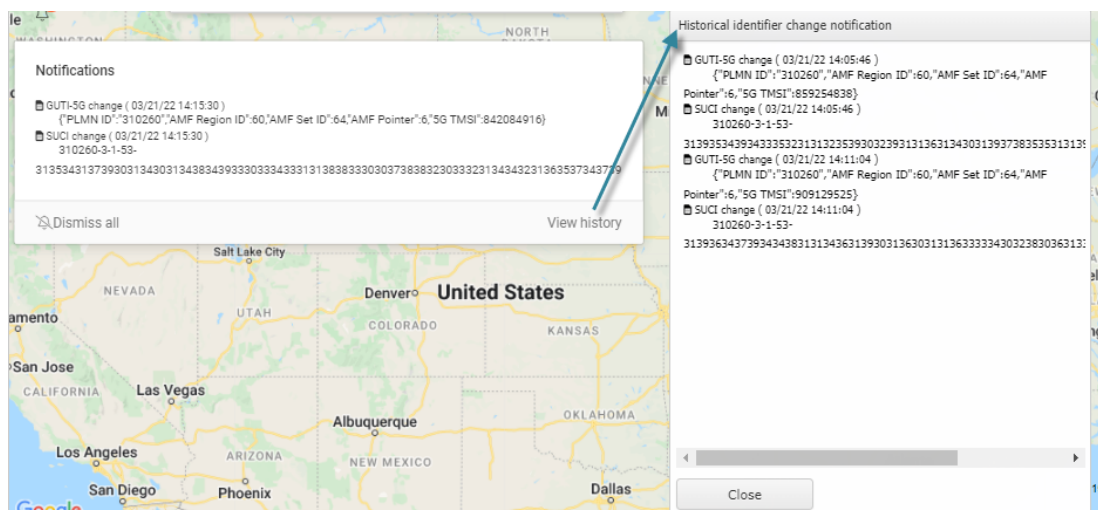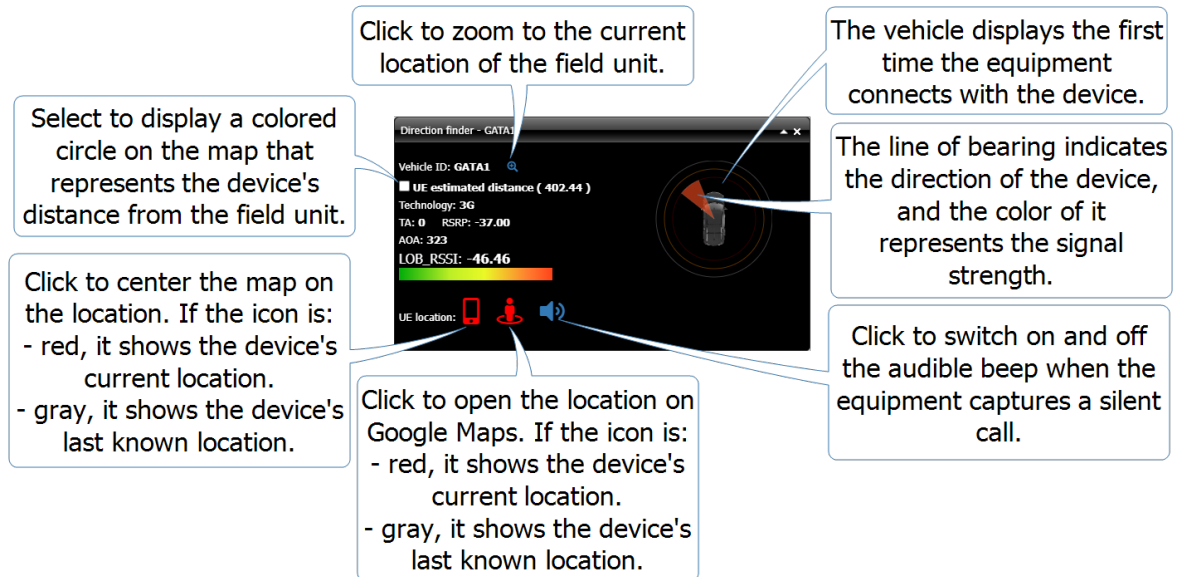
5. If you have field units with GATA equipment installed then you can also use them to help locate a device using the **Direction finder** pop-up. For the GATA field units that are currently active, a **Direction finder** pop-up is either displayed in the field unit's tab or as a floating window.

If the **Direction finder** pop-up does not display then click [Views icon]. On the **GATA Views** dialog box, ensure that in **GATA**, **Direction finder** is selected.

The following graphic explains how to use the **Direction finder** pop-up to help locate a device.

Click to zoom to the current location of the field unit.

The vehicle displays the first time the equipment connects with the device.

Select to display a colored circle on the map that represents the device's distance from the field unit.

The line of bearing indicates the direction of the device, and the color of it represents the signal strength.

Click to center the map on the location. If the icon is:
- red, it shows the device's current location.
- gray, it shows the device's last known location.

Click to switch on and off the audible beep when the equipment captures a silent call.

Click to open the location on Google Maps. If the icon is:
- red, it shows the device's current location.
- gray, it shows the device's last known location.

Direction finder - GATA1
Vehicle ID: **GATA1**
■ **UE estimated distance (402.44)**
Technology: **3G**
TA: **0**   RSRP: **-37.00**
AOA: **323**
LOB_RSSI: **-46.46**
UE location:

6. If required you can change how the field units appear on the map, such as displaying the route's signal color and the appearance of the **Direction finder** pop-up. Any changes you make to a field unit's settings will also change for all GATA and OSS-ESPA users, and in all cases. To change a field unit's appearance:
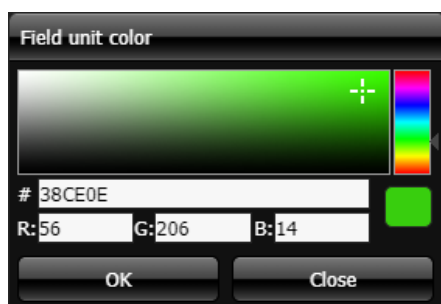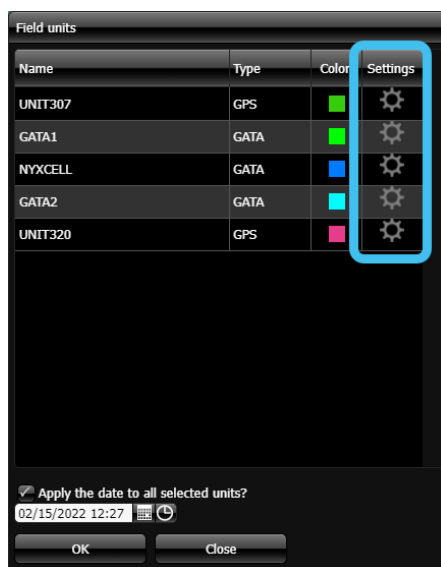
a. Click .
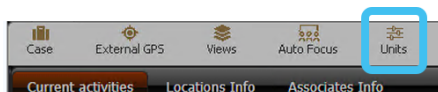
The **Field units** dialog box opens.

b. If you want to set the color the field unit's marker and trails are displayed in, click the color icon.
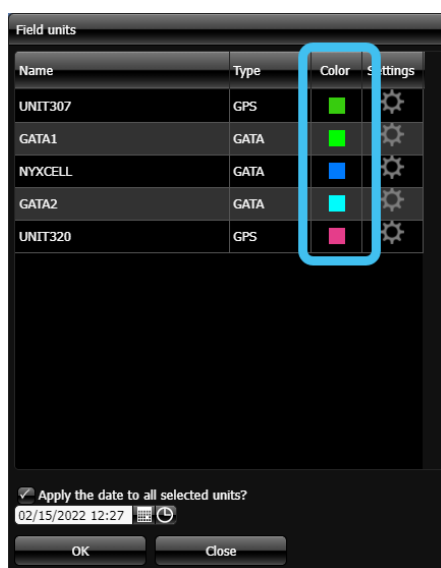
The **Field unit color** dialog opens, select a new color then click **OK**.

c. If you want to configure any other settings associated with a field unit, such as using a transparent background in the direction finder window, using a floating direction finder window, displaying the signal strength in the bread crumb trail and the appearance of the unit and signal icons, then click .

The **Unit settings** dialog box opens. Configure the settings as required then click **OK**. For further information on the settings refer to **Unit settings dialog box on page 80**.
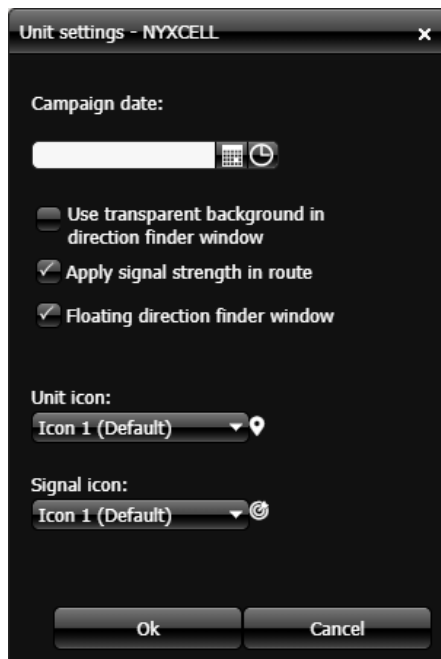
d.   Click **OK** to close the **Field units** dialog box.

Setting the map location and scale

You may want the map location and zoom to remain the same as you have them currently displayed on the map. This can be useful for a number of reasons, for example: you may wish to monitor movements around a specific location, or it may give you a better overall view of the location of a new event when it occurs rather than it zooming in closely to the event which may make it difficult for you to at first determine the new location relative to the previous one. To do this, set the map to your preferred location and zoom setting then click
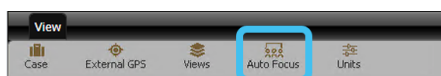
 .

Using auto focus in GATA

Auto focus allows you to set whether or not the map automatically centers a new event on the map when it arrives.
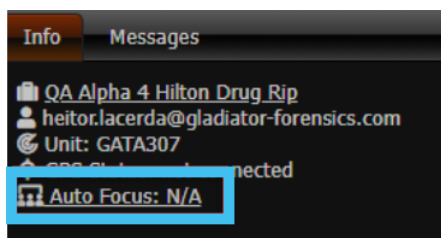
To enable and disable auto focus:

1. Either:

    -   On the **GATA** panel click , or

    -   On the **Info** tab, at the bottom-left of the screen click **Auto focus**.

    The **Auto focus dialog box on page 69** opens.
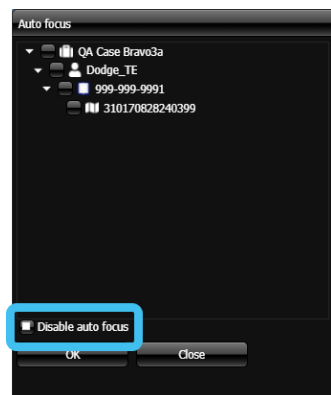
2. The **Auto focus** dialog box allows you to both enable and disable auto focus.

    -   To auto focus on a target, select the target you want to auto focus on.

    > **NOTE**: To auto focus on a specific phone or CASEID (LIID) , the phone number or CASEID (LIID) itself must be selected on the **Case Settings dialog box on page 72**.
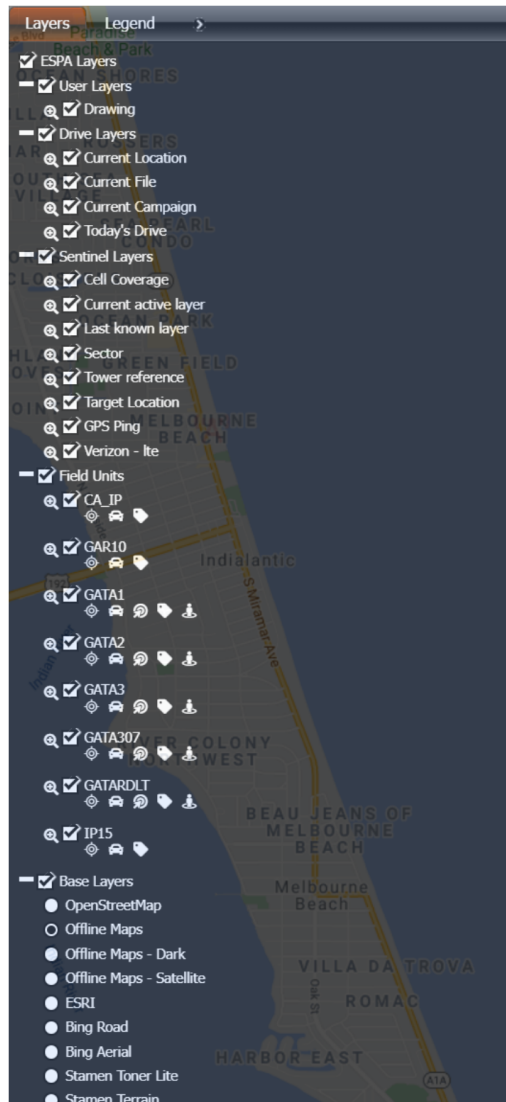
- To disable auto focus, select **Disable auto focus**.

Using the GATA Layers panel

The **Layers** tab, on the right of the screen, allows you to select what information to display in the map.
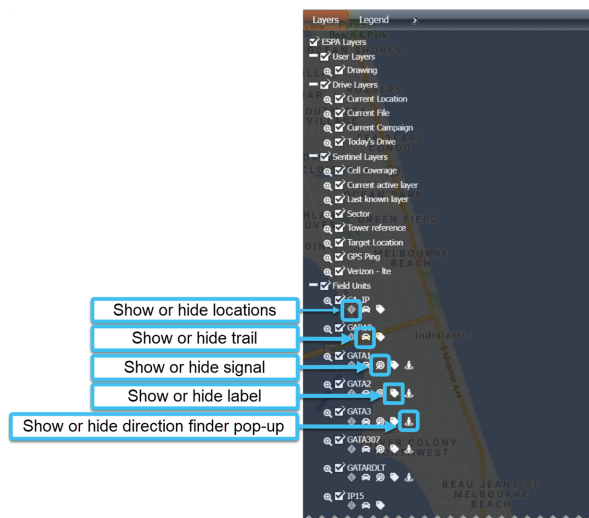
How to show and hide the field unit layers

For each field unit you can select to show and hide the field unit's:

- locations

- trail

- label

- signal

- direction finder pop-up

1. Use the **Field units** menu to select the layers you want displayed for each field unit.
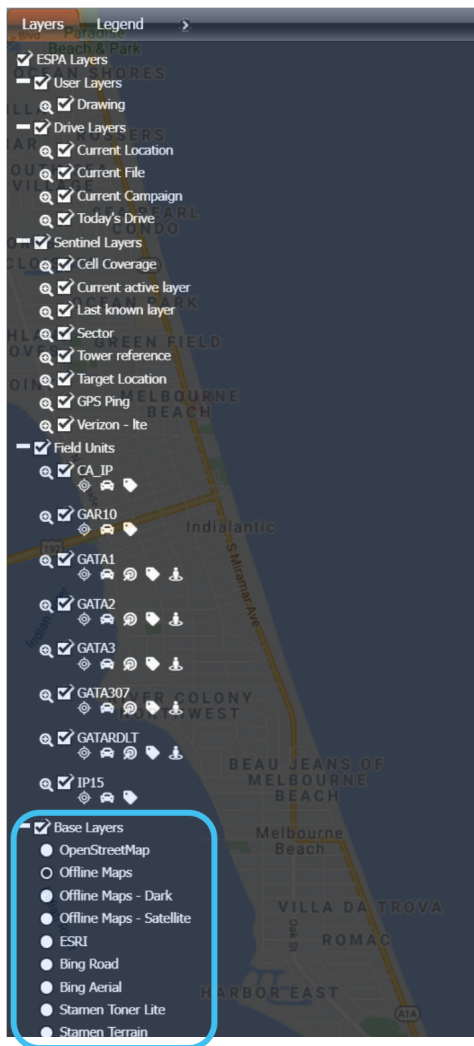
How to change the base layer

Changing the base layer changes which map type is displayed.

> **NOTE**: Offline maps do not require internet connectivity as they load directly from your computer. For further information refer to **Downloading offline map regions on page 52**.

1. Use the **Base Layers** menu at the bottom of the tab to change the displayed map.

Measuring distance

You may want to measure the distance between different locations, for example if you believe a person is heading for a particular location measuring the distance between their current location and their destination could give you an approximate time for their arrival.

With your map displaying the points you want to measure between:

1. Click at the top-left of the map to ensure the map is in the measure distance mode. This icon is displayed in orange when you are in the measure distance mode.

2. Left-click on the map to start measuring your distance. You can left-click to create another point on your distance measurement or double left-click to complete your distance measurement.

   The distance is displayed in miles.
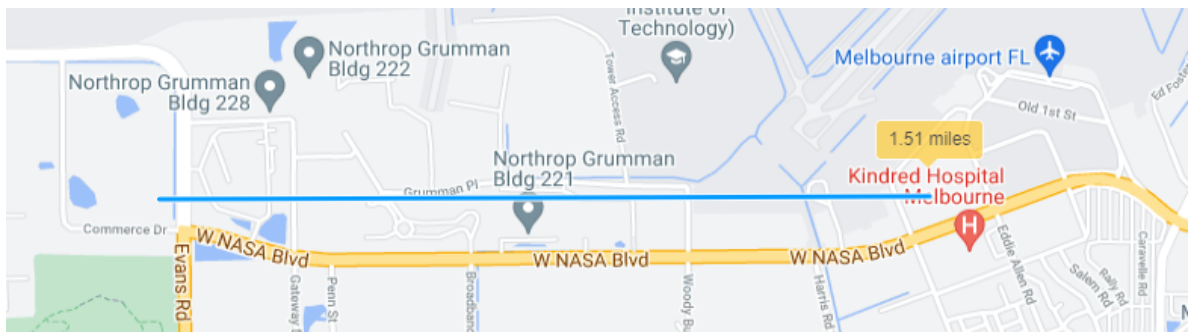
Once you've completed your measurement right-click the map to return to the normal map mode which is indicated by the hand icon returning to orange .

Viewing locations of interest

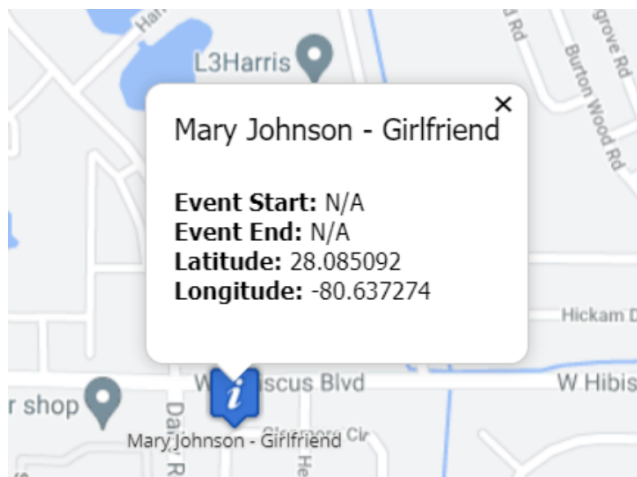Locations of interest, that have been added to the case, are marked on the map with icons as shown below.

Click on an icon on the map to display details about the location such as its name, latitude/longitude and event start/end times.

Viewing sector properties

Click on a sector to display the sector properties such as the technology, azimuth and beamwidth.
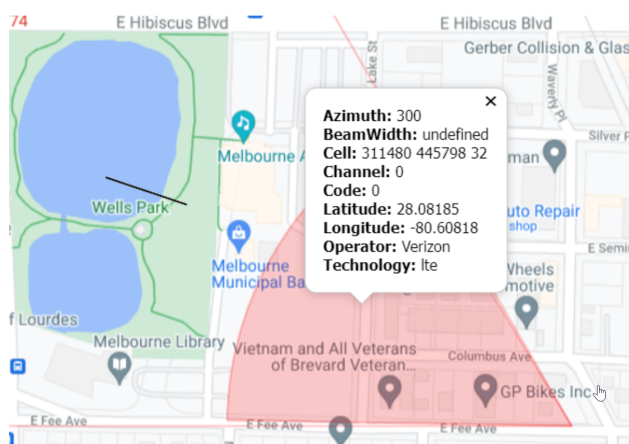
Viewing the best RSSI details

The best RSSI level is displayed on the map with a . Click on it to display details of the RSSI such as the level, time it occurred and latitude/longitude.
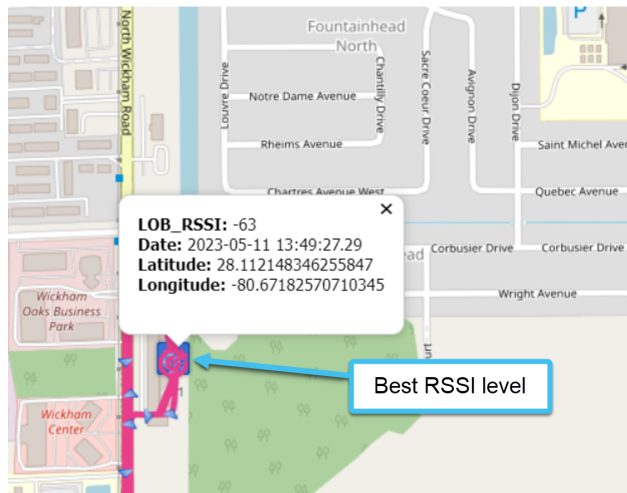
Viewing the drive trail's direction of travel

The drive trail's direction of travel is marked on the map with arrows.

Downloading offline map regions

If you prefer to use offline maps, for example if you know you are going to be in an area with no internet access, then you can download maps to your computer before you start your mission.
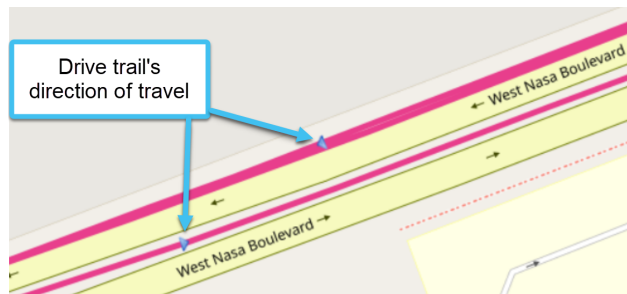
1. Click on the right hand side of the screen.
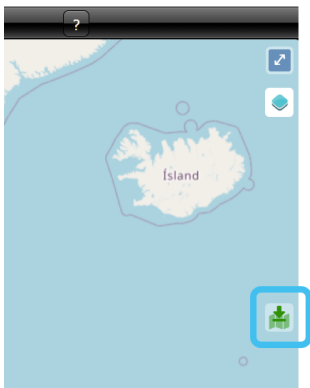
A new **OSS Maps** browser tab opens.

2. Use **Search** to locate the region you want to download.

Description	Date modified	Size	
Alabama	2021-10-07	10.3GB	Download
Arizona	2021-10-07	5.5GB	Download
Arkansas	2021-10-07	7.1GB	Download
California	2021-10-08	19.6GB	Download
Colorado	2021-10-07	5.6GB	Download
Connecticut	2021-10-06	4.2GB	Download
Dark - Alabama	2022-04-23	7.6GB	Download
Dark - Arizona	2022-04-24	8.8GB	Download
Dark - Arkansas	2022-04-23	6.0GB	Download
Dark - California	2022-04-30	31.9GB	Download

Show 10 entries   Search:

Showing 1 to 10 of 104 entries   Previous 1 2 3 4 5 ... 11 Next

3. You can select your preference between either a standard or dark map for the region. If you prefer, you can also download both as you can select which to use in step 5.

4. Once downloaded, move the .gmbd file to `C:\GATA\Offline Maps`.

Alternatively, if you prefer to have each region's download in a separate folder you can also use `C:\GATA\Offline Maps\<region name>`.

5. To use the offline maps, on the **Layers** panel, select your preference either **Offline Maps** or **Offline Maps - Dark**.
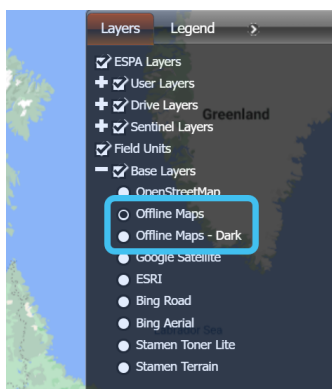
NOTE: If you have selected to use offline maps and you do not have the required download but you are connected to the internet then internet maps are used automatically.

2.6.2 Using an external GPS device

This topic describes how to use an external GPS device to provide GATA with your location so that your movements can be monitored if you are not using a GAR or OTA unit. For an overview of the external GPS tracking feature refer to the **Read GPS from external device dialog box on page 79**.

1. On the **Map View**, click on the left of the map.

   The **GATA** panel opens.
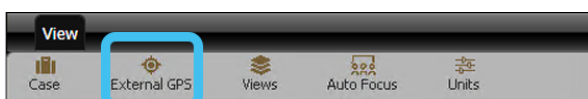
2. Click .

   The **Read GPS from external device dialog box on page 79** opens.

3. If prompted, allow access to your location.

4. In **COM Port**, select the USB port your GPS device is connected to.

5. Click **Start**.

   Your location is now identified on the map with a marker, this information is updated every second.

   > **NOTE**: If this is the first time you have set up this unit then you must ensure that it is configured on OSS-ESPA's Sentinel screen to display in the correct cases. For further information refer to "How to display GPS Tracker and field units on the Sentinel screen" in the OSS-ESPA Help.

6. If you want to view the movements of other devices, you can select them from the **Layers** panel. Click at the right-side of the map to open the panel, then expand **Field units** and select the devices you want to display.
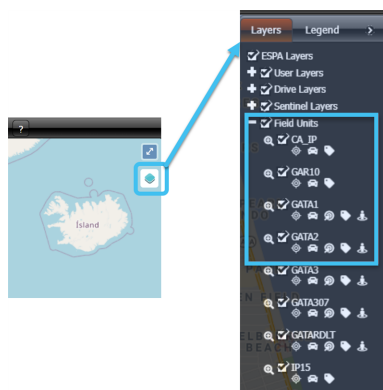
3 Software description

The GAR unit uses a simple and intuitive user interface to allow you to configure and run collections.

This interface includes the following elements:

- **Startup**: a two screen wizard allowing you to configure and run a discovery scan, and cellular and Wi-Fi coverage data collection.

- **View**:

    - **Map**, **Graph**, and **Grid**: these screens display the collected cellular coverage data.

    - **Network Info**: this screen displays data about surveilled cellular devices and WiFi networks, and also displays decoded messages.

    - **Device Info**: this screen displays information about detected WiFi-enabled devices, for example cell phones and laptops, which are connected to a wireless access point.

    - **RF Spectrum**: this screen displays the results of an RF spectrum scan.

    - **Summary**: this screen shows summary information about the collected data after the collection is completed.

- **Analysis**: this screen displays current and previous analyses run on the collected cellular and WiFi coverage data.

- **Logs and settings**: displays information about the status of the GAR unit.

- **Status icon**: displayed at the top of the interface to indicate the GAR unit's status.

3.1 Overview of GUI

The GAR unit uses tabs and panels to help you manage and run collections.

Tabs are sections of a screen which you can click to navigate to another screen.

Panels are sections of a screen which display information and options.

3.2 Status

GAR status:

- **Idle**

  No discovery or collection is running on the GAR unit.

  When you open the GAR user interface, the drive run wizard home page is displayed.

- **Collection**

  The GAR unit is running a cellular coverage data collection.

  When you open the GAR user interface, the **Map** screen is displayed.

- **Autonomous**

  The GAR unit is set to perform a discovery scan and a collection at the same time. It runs a collection on operators, technologies, and bands as soon as it identifies them.

  When you open the GAR user interface, the **Map** screen is displayed.

- **No RX Connection**

  This indicates that the GPS has frozen. To resolve this, check the integrity of your GPS antenna including the connection before restarting.

GATA status:

- **Connected**

  GATA is connected to the internet and transmitting and receiving data with OSS-ESPA.

- **Reconnecting**

  GATA is attempting to reconnect to the internet and is currently unable to transmit and receive data with OSS-ESPA.

- **Disconnected**

  GATA is disconnected from internet and is currently unable to transmit and receive data with OSS-ESPA.

3.2.1 Status icon

The GAR interface displays the receiver status using the status icon at the top of screen.

The status icon displays the receiver status and one of the following traffic lights as a visual indicator:

- **Orange**: receiver status is **Idle**.

- **Green**: receiver status is **Discovery** or **Collection**, and there are no errors.

- **Red**: receiver status is **Discovery** or **Collection**, and there is an error.

3.3 Startup

Startup allows you to configure and run a cellular coverage and Wi-Fi data collection.

3.3.1 Choose mode

Choose mode is the first screen of Startup.
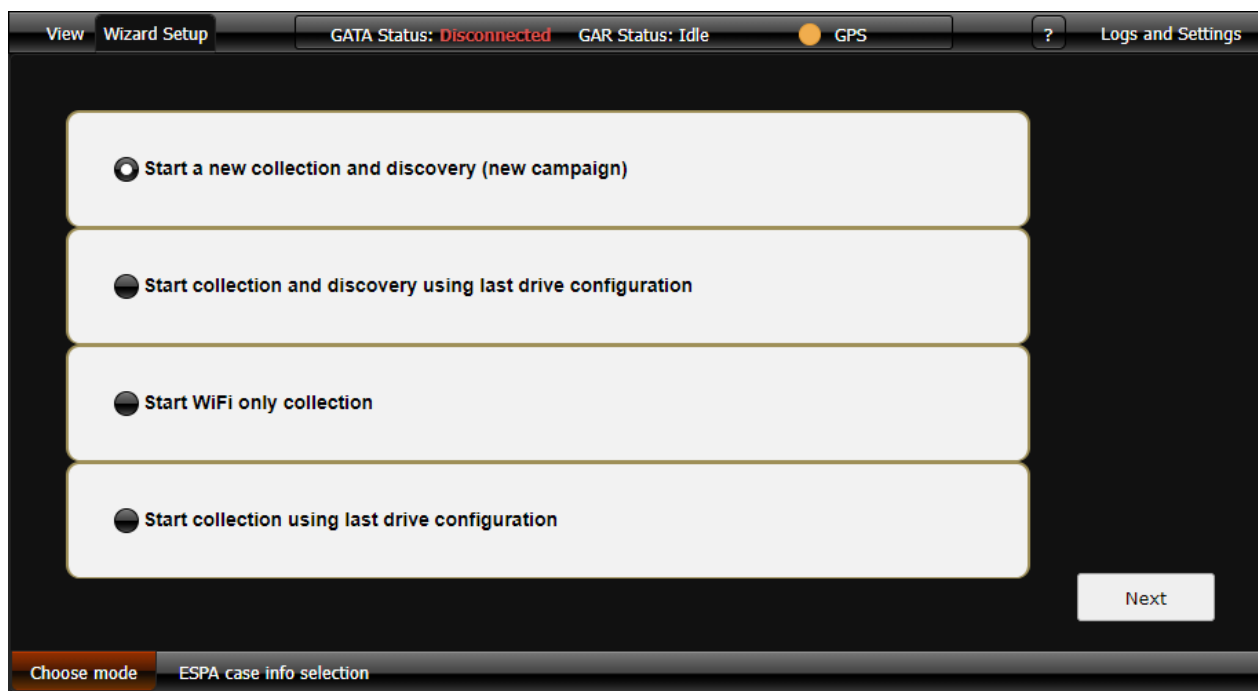
The **Choose mode** screen gives you the following options for running a collection:

- **Start a new collection and discovery (new campaign)**

  For further information, refer to **Start a new collection and discovery (new campaign) on page 11**.

- **Start collection and discovery using last drive configuration**

  For further information, refer to **Start a collection and discovery using the last drive configuration on page 13**.

- **Start WiFi only collection**

  For further information, refer to **Start WiFi only collection on page 15**.

- **Start collection using last drive configuration**

  For further information, refer to **Start a collection using the last drive configuration on page 17**.

3.3.2 ESPA case info selection

The **ESPA case info selection** screen displays options for selecting exported case data to display on the **Map** screen with the current collection data.
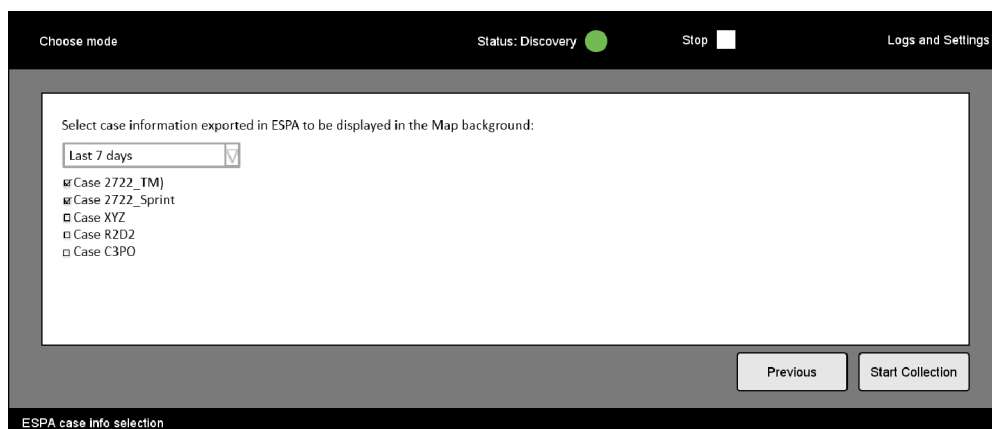
You can select multiple exports from OSS-ESPA. On the **Map** screen's **Layers** panel you can then select which ones you want to display.
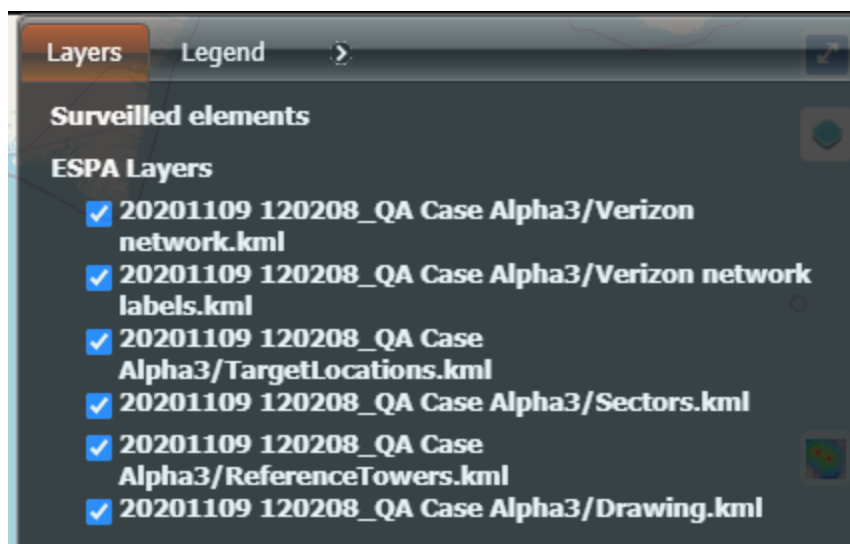
When the GAR unit is in collection mode, **Start collection** is grayed out.

If you cannot select **Start collection**, check the GAR unit status.

If you want to change these settings when the GAR unit is in **Autonomous** or **Collection** mode, click to open the **Layer settings** dialog box, then on the **ESPA Layer** tab make the required change.

3.4 Views

The GAR unit displays information using map, graph, and grid screens.

3.4.1 Map

On the **Map** screen, the user interface displays data relating to a GAR collection in map form. In addition the GATA feature displays case data that is useful when you are conducting a real-time tracking mission.
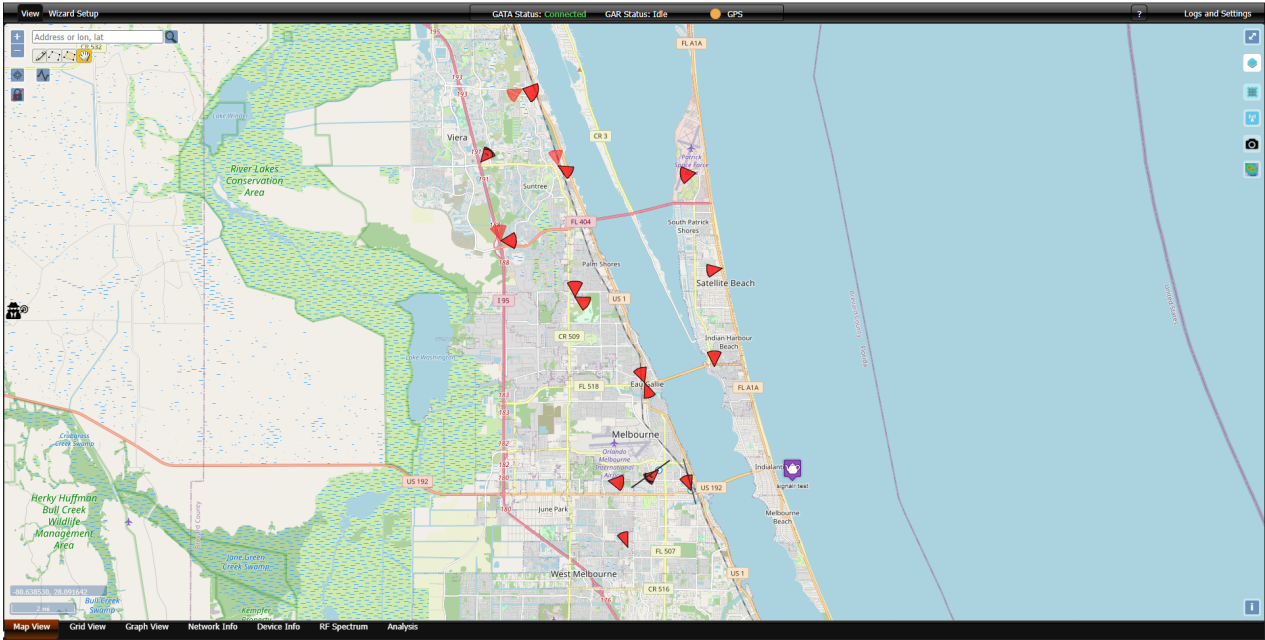
You can rotate the map so that the top is oriented to a direction other than north.

- **Touchscreen**: touch an area with two fingers and drag both fingers in a circular motion.

- **Laptop**: press Shift and drag the cursor.

To reorient the map back to north, click [icon].

Additional tools and options are available to control the **Map** screen and access other features.

Icon	Option	Description
[search field]	Search	Allows you to search for a location on the map by street address or longitude/latitude coordinates. To search by coordinates, enter the longitude before the latitude.
[lock icon]	Map lock	Allows you to lock the map if you prefer to view a specific map location.

Icon	Option	Description
	Base station	Allows you to conduct a base station analysis.
	MCLA	Allows you to conduct an MCLA analysis.
	Indoor mode	Switches the navigation mode to Indoor. This option is only available if you have configured collections to run in Indoor or Indoor+GPS mode. This is set using **Navigation mode** on the **Current Configuration on page 92** screen when the **Status** is Idle.
	GPS mode	Switches the navigation mode to GPS. This option is only available if you have configured collections to run in GPS or Indoor+GPS mode. This is set using **Navigation mode** on the **Current Configuration on page 92** screen when the **Status** is Idle.
	Full screen	Allows you to expand the map windows to fill the screen. This option is only available on certain browsers.
	Center	Allows you to refocus the map to set your field unit's current location as the center of the map.
	Zoom	Allows you to narrow or expand the focus of the **Map** screen.
	Layers and Legend	Allows you to select what data is displayed on the **Map** screen. For example: **Current location**: the data from the current collection **Today's drive**: the data from previous collections carried out on the day of the current collection **Current campaign** : the data from all collections in the campaign from the start day until the day before the current collection **Current file**: the data from the current file under collection **Sentinel layers**: this allows you to select which case data received from OSS-ESPA's Sentinel solution is displayed. **Offline maps**: these are useful to display if you have no internet connection. **Field units**: Each active field unit allows you to select which of its attributes are displayed, for example the **Direction finder pop-up on page 74** and the unit's name.

Icon	Option	Description
	Drawing tools	Allows you to draw shapes on the map to conduct analyses on data collected on locations within. Drawn polygons must be saved using the context menu before they can be used.
	Collection status	Displays a summary of the status of the GAR unit collection for each technology, and additional functions such as file upload, in a popup window.
	Snapshot current location	Allows you to conduct a snapshot analysis, which identifies which cell towers provide coverage in a specific location. **For current location**: select if you want the map's current central location used as latitude and longitude for the snapshot analysis. **By file**: select if you want to select specific GAR data files to be used for the snapshot analysis.
	Cell coverage	Allows you to conduct a coverage analysis which plots your selected coverage data on the map.
	Settings and Export	Allows you to change which exported case data is displayed on the **Map** screen with the current collection data, and export the GAR .gtz files to the Rover file format.
	Download maps	Click to download offline maps for using with GATA.
	Notifications	This appears automatically if there is any change to a device's subscriber information (IMSI, MSISDN, SUPI-IMSI, GPSI-MSISDN, SUCI, GUTI-5G) and the device information (IMEI, IMEISV, PEI-IMEI, PEI-IMEISV). This type of alert notifies you of pertinent changes related to the target device which may require you to reconfigure other mission equipment in order to accomplish your mission.
	GATA panel	Allows you to open the GATA panel used in real-time tracking.

Context menu

You can use a context menu on the **Map** screen to do the following:
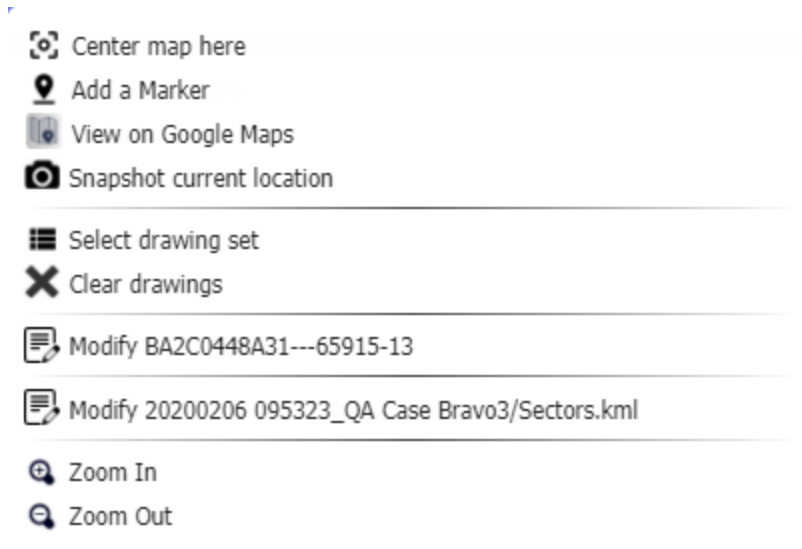
- Center the map on a location

- **Add a Marker** to a location

- View the location on Google Maps. This is useful as it provides you with a visual display of the landscape.

- Snapshot to identify which cell towers provide coverage in a specific location

- Edit and save polygons you have created using the drawing tools

- **Zoom in** and **Zoom out**

- Modify the opacity and radius of a Sector, or all Sectors in a layer

To open the context menu using a laptop, right-click the location on the map.

To open the context menu using a touchscreen device, tap and hold down on the location on the map until the context menu opens.

Layers and Legend panel

The GAR unit displays the results of analyses, surveilled elements, and devices using a layered display on the **Map** screen.

To configure how these results and GATA data are displayed, use the **Layers** panel next to the map.
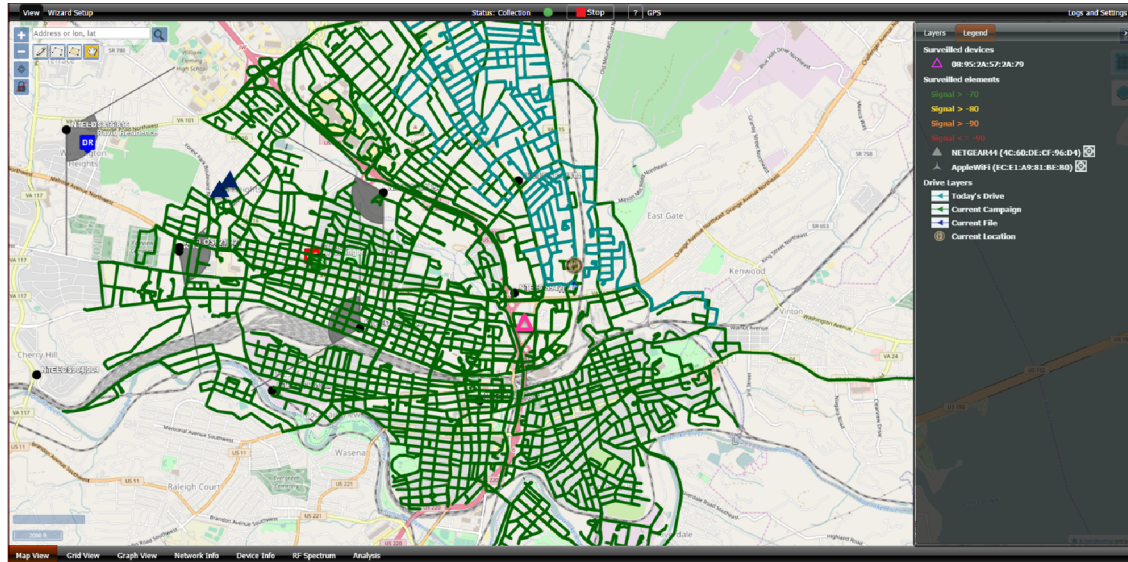
- **Layers**: select which layers to display in the map, and set the attributes displayed for each layer. For GATA layers, refer to **Using the GATA Layers panel on page 46**.

- **Legend**: indicates the attributes displayed in the map. Check-boxes allow you to select what you want displayed, and the allows you to zoom into the item.

    - **Surveilled Devices**

        The GAR unit displays the devices you have chosen to surveil.

        To choose devices to surveil, use the **Device Info** screen.

        For further information, refer to **Device Info on page 88**.

    - **Surveilled Elements**

        The GAR unit displays the elements you have chosen to surveil.

        To choose elements to surveil, use the **Network Info** screen.

        For further information, refer to **Select elements to surveil on page 27**.

        The GAR unit displays the signal location of each element as a different shape or icon. The GAR unit indicates the signal strength of each element with the color of the shape or icon according to the legend.

At any time, the location of the strongest detected signal for an element is shown in blue. If there are multiple locations broadcasting the same strongest signal, those locations are all shown in blue.

To zoom in to the strongest detected signal, select .

- **Drive Layers**

  The GAR unit displays the drive routes and the breadcrumbs trail of the collection drive route as different colors.

  You can use breadcrumbs to display the strongest signal detected for surveilled devices and elements on the map. This can be useful, for example, when trying to triangulate a signal to locate the emitting device.

- **Base Station Location Layers**

  The results of a base station analysis can be displayed on the map. Use the filter to define what base stations you want to display.

GATA panel

The map view's GATA (Gladiator Automated Target Acquisition) panel is opened by clicking on the left of the map.
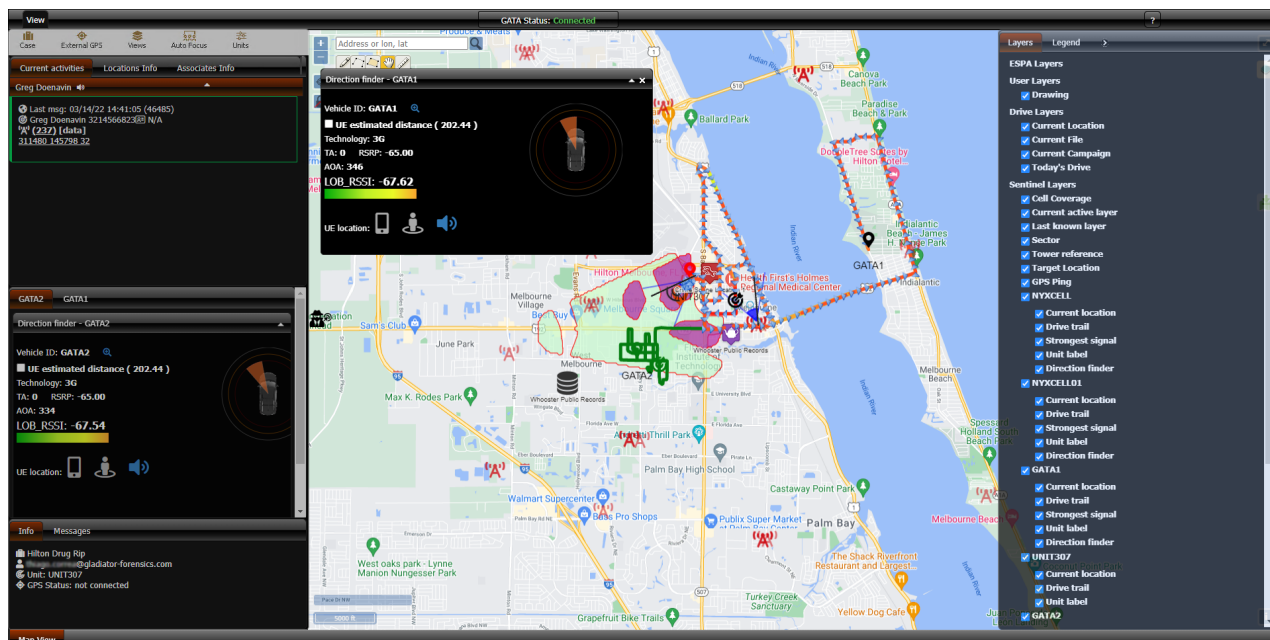
The GATA panel consists of a **Current activities** tab, **Locations Info** tab, **Associates Info** tab and individual field unit tabs for all the selected case's active GATA field units. There are also buttons that allow you to configure your GATA view.

- **Current activities**: displays the details of any current communication activities. Typically these activities are outlined with a green box to indicate they are active. When an activity ends it remains on this tab for ten seconds and is displayed with a red outline. You can click the tower reference number to center the cell tower's location on the map. To investigate the location further you can click the cell identifier to open the location on a separate browser tab in Google Maps.
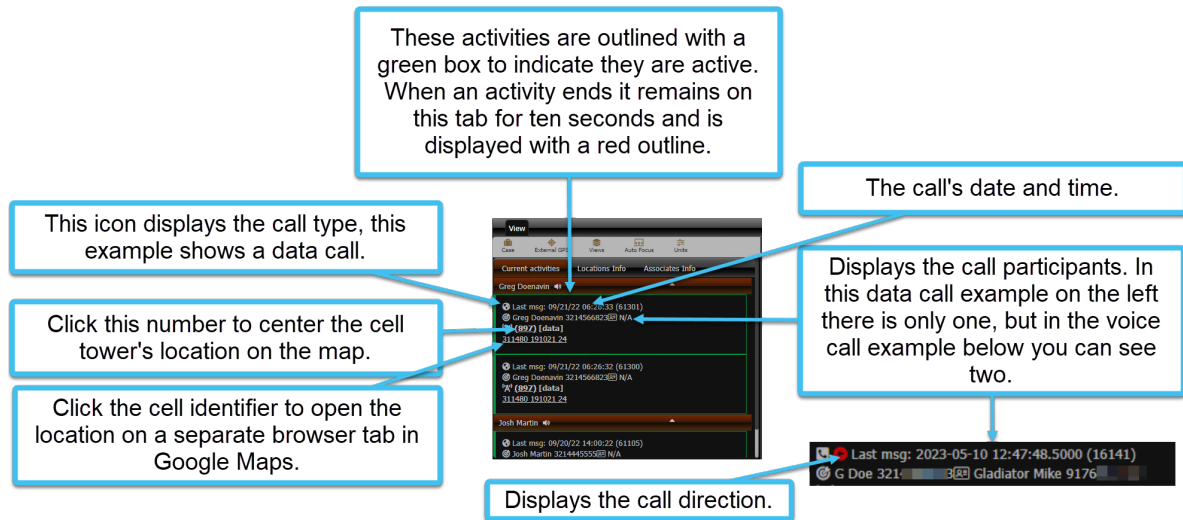
- **Locations Info**: displays by default the details of the last ten locations for communications. You can change the number of locations from the default of ten using **Top** and clicking the refresh icon.

  You can click the date/time link to center the cell tower's location on the map. To investigate the location further you can click the cell identifier to open the location on a separate browser tab in Google Maps.

  Click **+** to display the target's call statistics. You can use the icons to filter what is displayed in the list and on map. You can filter on voice and VoIP calls, data calls, SMS and MMS calls, GPS pings, GPS buffer, tower, cell coverage and the dominant cell coverage.

  The icons at the top of the tab apply to all persons listed on the tab but you can also use the icons alongside each person's name. For the map details you can also click the icons listed for each location to display or hide them from the map.
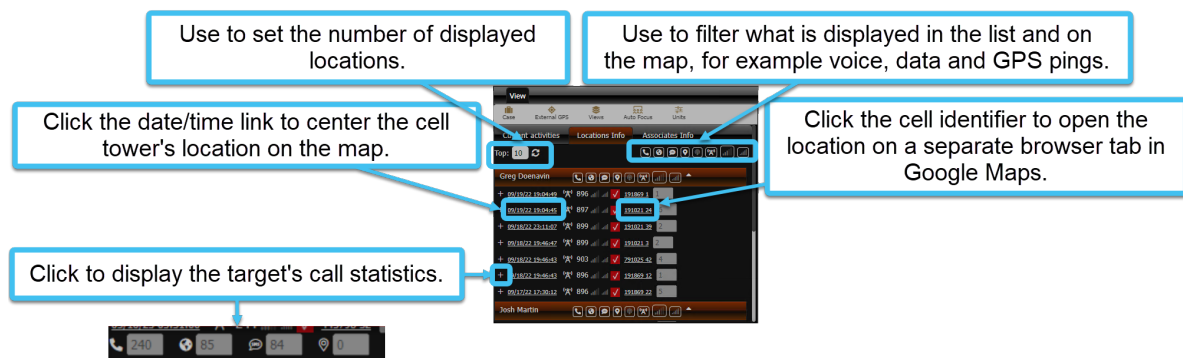
- **Associates Info**: displays by default the details of the last ten associates the target last communicated with, and the target's location during that communication. You can change the number of associates from the default of ten using **Top** and clicking the refresh icon.

  You can click the date/time link to center the cell tower's location on the map. To investigate the location further you can click the cell identifier to open the location on a separate browser tab in Google Maps. The arrow alongside the associate's name indicates if the call was incoming or outgoing.
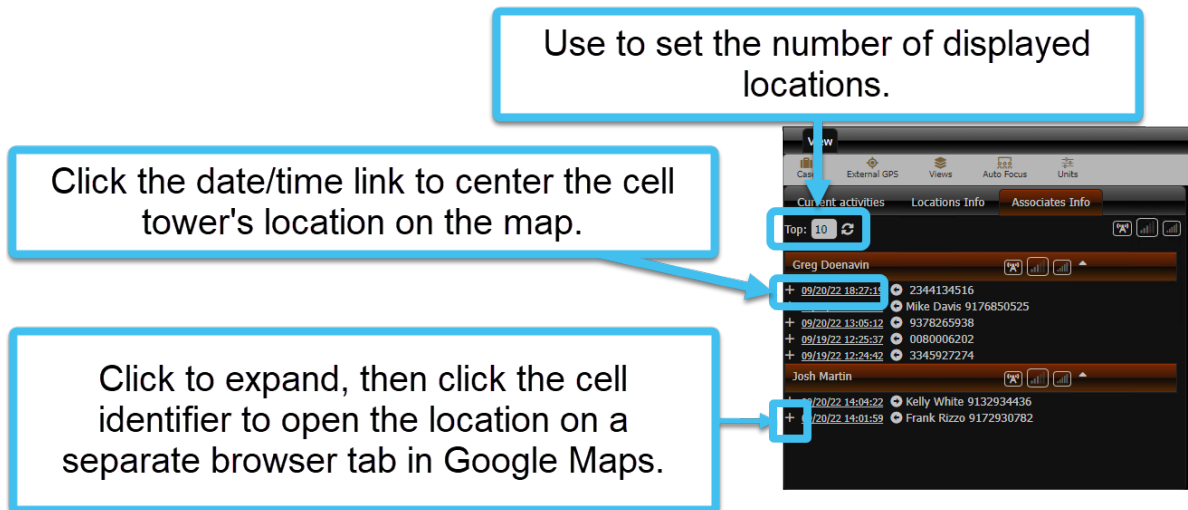
- **Field unit**: for each GATA field unit that is active a tab is displayed. It displays information gathered from the GATA field units which can help you find devices of interest. Each field unit tab is named using the field unit's name. Currently the only field unit feature implemented is the **Direction finder pop-up on page 74**.

  You can minimize this tab by clicking at the top-right of the tab.
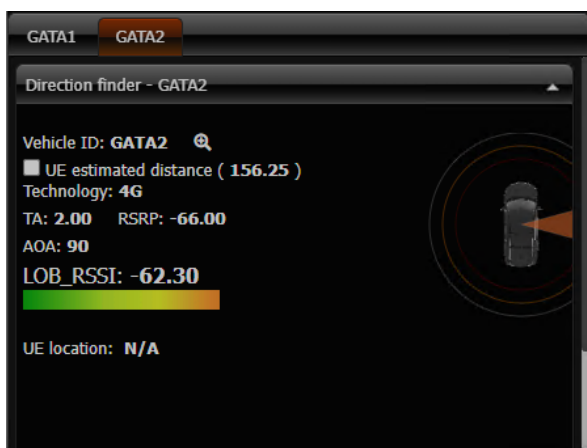
- **Info**: displays the case name that you are viewing and the name of the user that you are logged in as, both of which are set on the **Case Settings dialog box on page 72**. It also displays your field unit name and your GPS status.

  If the case has map data exported from the OSS-ESPA's Analysis center then a link is provided which opens the **Case data - Exported from Analysis Center dialog box on page 70** which allows you to view the available map exports and select any that you would like to display on the GATA map.
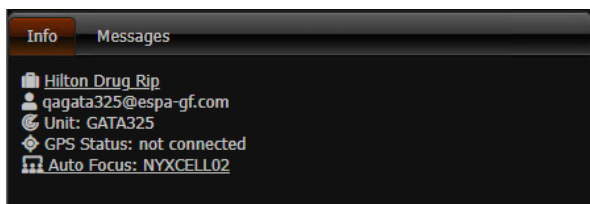
- **Messages**: displays information regarding the status of uploading data to Sentinel.
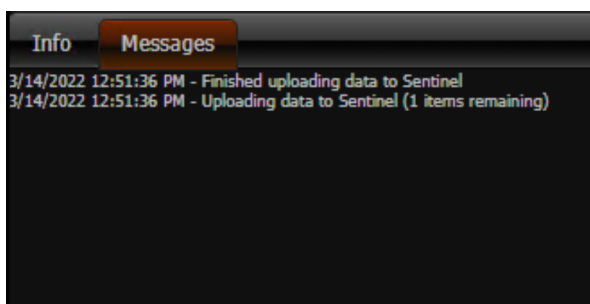
- **Case**: click to open the **Case Settings dialog box on page 72** which allows you to sign into your OSS-ESPA account and select which of your intercepts you want to view.

- **External GPS**: click to open the **Read GPS from external device dialog box on page 79** which allows you to give GATA access to your current location when you do not have a GAR unit or an Over-The-Air unit.

- **Views**: click to open the **GATA Views dialog box on page 79** which allows you to define which views you want displayed on the GATA field unit tabs.

- **Auto focus**: click to open the **Auto focus dialog box on page 69** which allows you to set whether or not the map automatically centers a new event on the map when it arrives.

- **Units**: click to open the **Field units dialog box on page 77** which allows you to open the **Field unit color dialog box on page 76** and the **Unit settings dialog box on page 80** which allow you to select how the field units and their data are displayed on your map.

Auto focus dialog box

The **Auto focus** dialog box is opened by clicking [Auto Focus icon] on the **GATA panel on page 65**. It allows you to set whether or not the map automatically centers a new event on the map when it arrives. The people, phones and CASEIDs (LIIDs) that are displayed are for the case you selected on the **Case Settings dialog box on page 72**. You can also set to center the map on a field unit each time it moves. The field units listed are either GAR and GATA units, Bluetooth GPS Cradlepoint units, and Over-The-Air units that have been selected on OSS-ESPA's **Sentinel** screen by the monitor for your case; that is the case you currently have selected on the **Case Settings dialog box on page 72**. Your selection is also retained for use at a later date when you reopen the case.

> **NOTE**: To auto focus on a specific phone or CASEID (LIID) , the phone number or CASEID (LIID) itself must be selected on the **Case Settings dialog box on page 72**.

This topic provides an overview of the **Case data - Exported from Analysis Center** dialog box. This dialog box is opened by clicking the case name on the **Info** tab on the **GATA panel on page 65**.

The **Case data - Exported from Analysis Center** dialog box list all the exported OSS-ESPA analysis center data that is available for the displayed case. You can select to display one or more exported data files.

This data is exported from the **ESPA analysis center** using and selecting **Export map to Sentinel**. The export is automatically named using the date and time of the export. The details that are exported are:

- Network and network labels: if either are selected then both are exported. However the only network locations which are exported are those in the current zoom area of the OSS-ESPA's map.

- Polygons: all polygons are exported irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map.

- Target locations: all target locations are exported irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map. In Google Earth the target location icons are displayed as they are in ESPA analysis center, however in MapPoint the target locations are only displayed using the same color as in ESPA analysis center but without the graphic.

- Sectors: all sectors are exported irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map.

- Towers by usage: all the usage details of each sector irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map are exported and can be viewed in Google Earth. In Google Earth the height of the sector represents its usage.

- Calls by day: all the calls from the selected phone numbers are exported and you can select to view them in Google Earth on a day by day basis.

- Cell coverage and WiFi coverage: all signal trails and drive trails are exported irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map.

- Geo-location: all the geo-location events and confidence circles are exported irrespective of whether or not they are in the current zoom area of the ESPA analysis center's map.

Case Settings dialog box

The **Case Settings** dialog box is opened by clicking [Case] on the **GATA panel on page 65**. It allows you to sign into your OSS-ESPA account and select which of your intercepts you want to view.

Email and Password

Enter your OSS-ESPA email address and password then click **OK** to sign in. The software is reloaded and synchronizes with OSS-ESPA. On returning to this dialog box your cases are automatically listed in **Cases**.

You do not have to sign in each time you open the software. You only need to sign in on your first use, or after another user has been signed in.

Cases

Once you are signed into OSS-ESPA using your **Email** and **Password** all your cases are automatically listed. Select the case you are monitoring. The case's people, phones and CASEIDs (LIIDs) are now listed.

View the last x hours

Select the previous number of hours you want to view for both:

- active and historical trails, and

- active calls.

The oldest data is removed from the screen when it becomes outside of the selected time period. The maximum value is 96 hours (4 days). The default is 8 hours.

Phones

This displays all the people, phones and CASEIDs (LIIDs) for the selected case. Select which ones you want to retrieve the data for. The data associated with these is then populated on the **Current activities** tab, **Last known** tab and the map.

If the i-case associated with the phone is either disabled or no longer valid it will display as .

Direction finder pop-up

The **Direction finder** pop-up displays information gathered from GATA field units which can help you find devices of interest. The pop-up displays the current or last known location, the signal strength, the line of bearing, and the distance from the device.

The following graphic explains the features of the **Direction finder** pop-up.
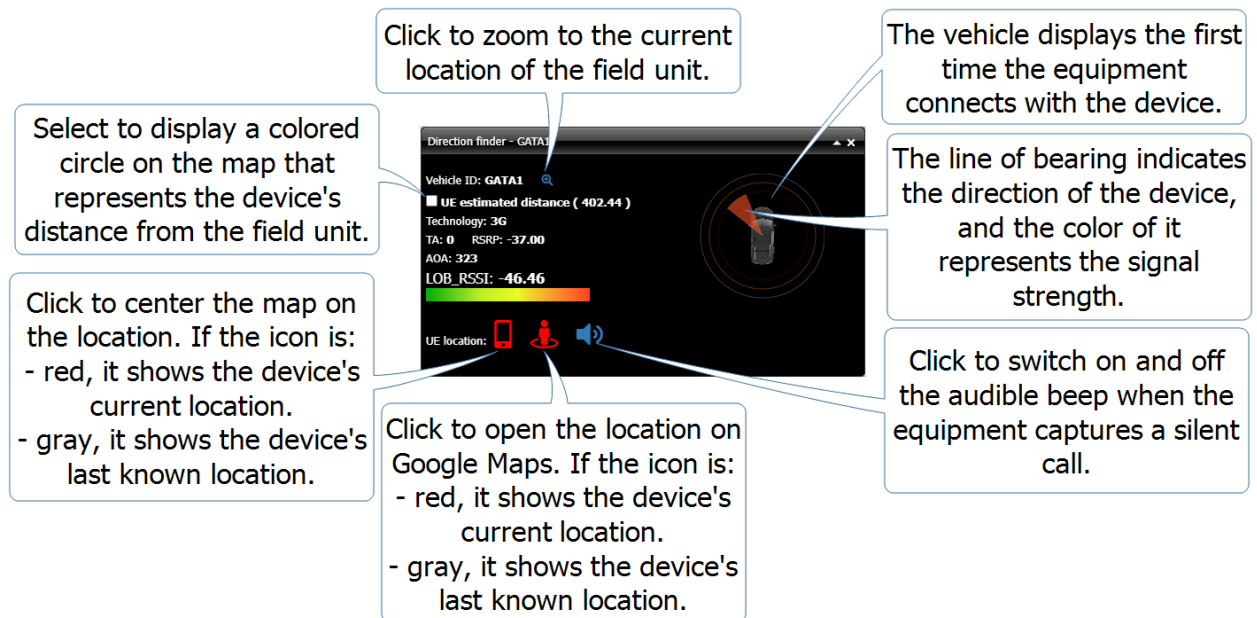
This graphic shows how the pop-up appears with red icons when the equipment is connected to the device via a silent call.
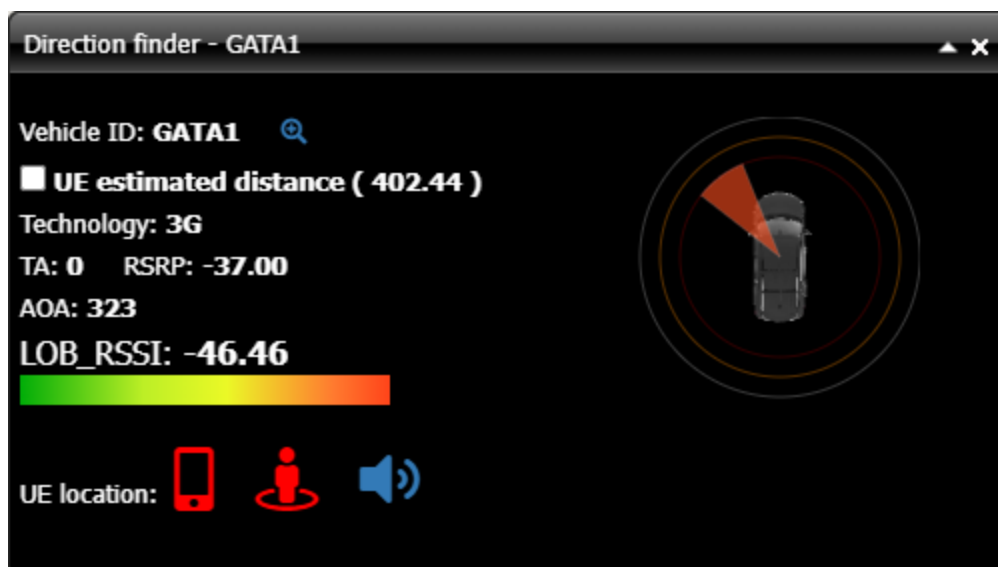
If any readings are invalid then:

- **No location** and no vehicle are displayed when the AOA value is invalid.

- **No signal** and no signal strength bar are displayed when the LOB_RSSI value is invalid.

To view the **Direction finder** pop-up you must have it selected to display on the **GATA Views dialog box on page 79**. You can also select:

- **Use transparent background in direction finder window on page 82** to display it with a transparent background which is useful if you are overlaying it on the map as it allows you to continue to view the street layout.

- **Floating direction finder window on page 82** which allows you to move it over the entire map rather than limiting it to the field unit tab.

For further information on using the **Direction finder** refer to **Monitoring movement on the Map View on page 36**.

The vehicle displays the first time the equipment connects with the device.

The line of bearing indicates the direction of the device, and the color of it represents the signal strength.

Click to zoom to the current location of the field unit on the map.

UE estimated distance

Select to display a colored circle on the map that represents the device's estimated distance from the field unit. This, along with the line of bearing can help you identify the location of the device.

Click to open the device's estimated location on Google Maps. If the icon is:

- red, the equipment is connected to the device and the location shown is the device's current location.

- gray, the equipment is not currently connected to the device and the location shown is the device's last known location.

Click to center the map on the device's estimated location. The location is displayed on the map using this same icon. If the icon is:

- red, the equipment is connected to the device and the location shown is the device's current location.

- gray, the equipment is not currently connected to the device and the location shown is the device's last known location.

Click to switch on and off the audible beep which occurs when the equipment captures a silent call indicating that it is connected to the device.

Field unit color dialog box

The **Field unit color** dialog box allows you to select the color you want the field unit's marker and trail displayed in, on the map. This color is then applied to the selected field unit throughout your account. Therefore if you change the color, it will also change for all users and in all cases.
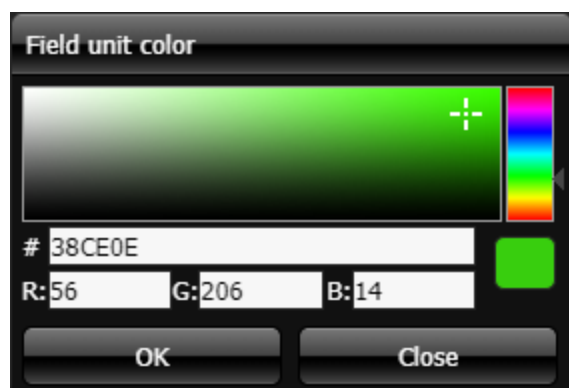
Field units dialog box

The **Field units** dialog box is opened by clicking [Units] on the **GATA panel on page 65**. The field units listed are either GAR and GATA units, Bluetooth GPS Cradlepoint units, and Over-The-Air units that have been selected on OSS-ESPA's **Sentinel** screen by the monitor for your case; that is the case you currently have selected on the **Case Settings dialog box on page 72**.

This dialog box also allows you to open the **Field unit color dialog box on page 76** and the **Unit settings dialog box on page 80** which allow you to select how the field units and their data are displayed on your map. You can set not only the appearance of your field unit on your map but also that of other personnel's field units.

> **NOTE**: Any changes you make to a field unit's settings will also change for all GATA and OSS-ESPA users, and in all cases.
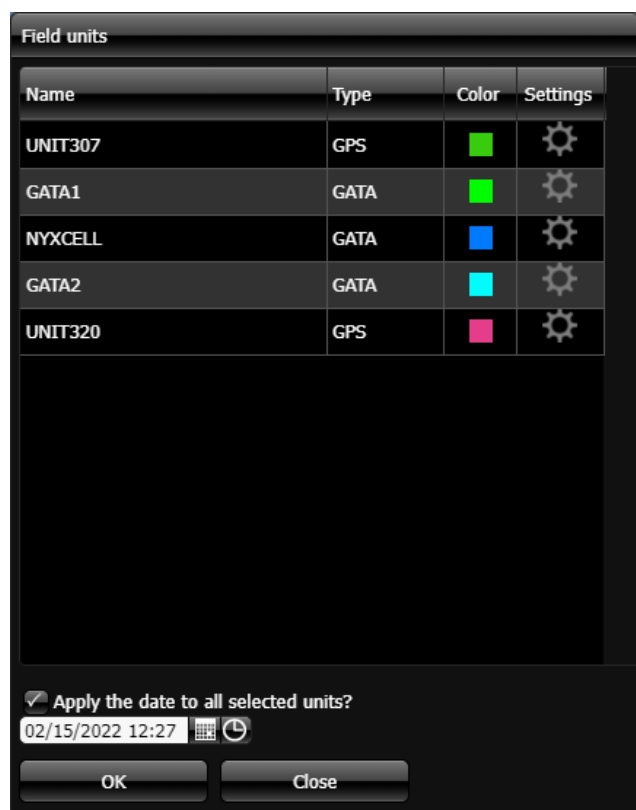
Color

Click on a field unit's color to open the **Field unit color dialog box on page 76**. This dialog box allows you to select which color you want the field unit's location and trails displayed in on the map. This color is then applied to the selected field unit throughout your account. Therefore if you change the color, it will also change for all users and in all cases.

⚙ Settings

Click to open the **Unit settings dialog box on page 80**. This dialog box allows you to configure which campaign date is displayed and how the field unit data is displayed on the map.

Apply the date to all selected units?

By default this is set to the current date, however if you have a specific campaign date you want used for all the field units then select the date and time of the campaign. Note, this setting overrides any date you have selected in an individual field unit's **Campaign date on page 81**.

GATA Views dialog box

The **GATA Views** dialog box is opened by clicking ▨ Views on the **GATA panel on page 65**. It allows you to define which views you want displayed on the GATA field unit tabs. Currently only the **Direction finder** is implemented, for further information refer to the **Direction finder pop-up on page 74**.
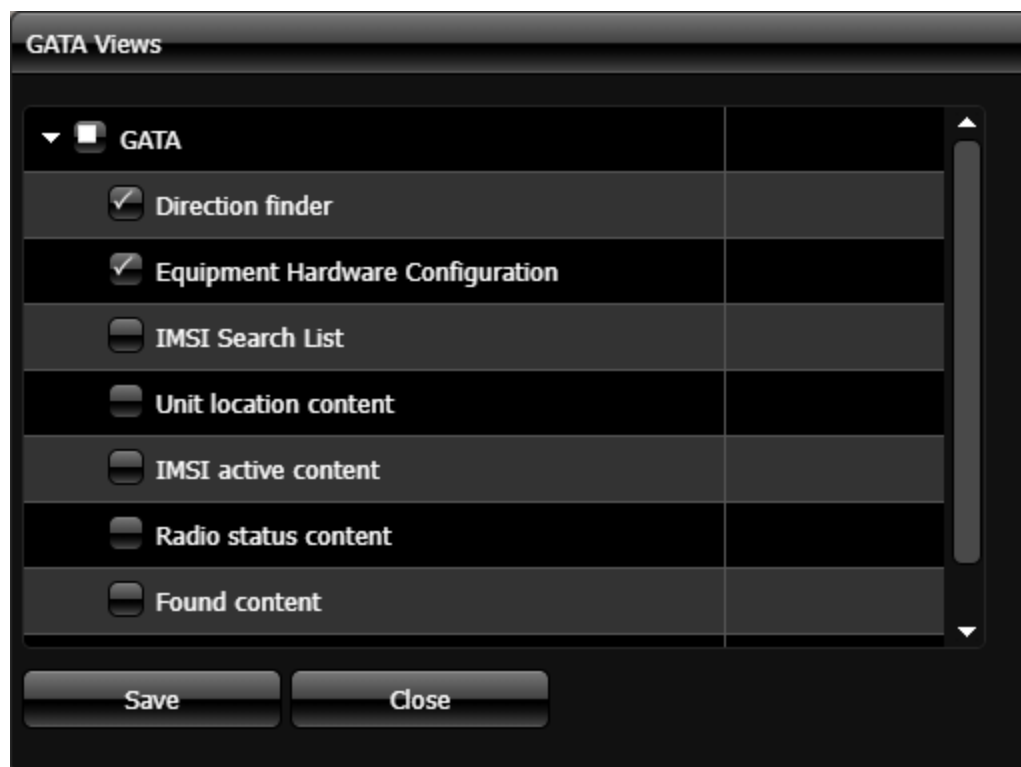
Read GPS from external device dialog box

The **Read GPS from external device** dialog box is opened by clicking ◈ External GPS on the **GATA panel on page 65**. It allows you to give GATA access to your current location when you do not have a GAR unit or an Over-The-Air unit. This location data is then displayed on the GATA map and on OSS-ESPA's **Sentinel** screen, where your movements can be monitored. This allows you and other personnel, to determine your position relative to a point of interest, such as a location or a suspect. It allows all personnel using GATA to monitor areas you are searching, which means it is easier for monitors to direct personnel to useful search areas and avoid multiple personnel searching the same areas.

To use an external GPS device you must use this dialog box to select the USB port that the GPS device is connected to, for example your phone. Both USB and bluetooth GPS are supported. If you are using a phone you must also ensure it does not lock. Once you have started the tracking, your location is updated on both the GATA map and on OSS-ESPA's **Sentinel** screen every second.

If you require information on using an external GPS device refer to **Using an external GPS device on page 54**.
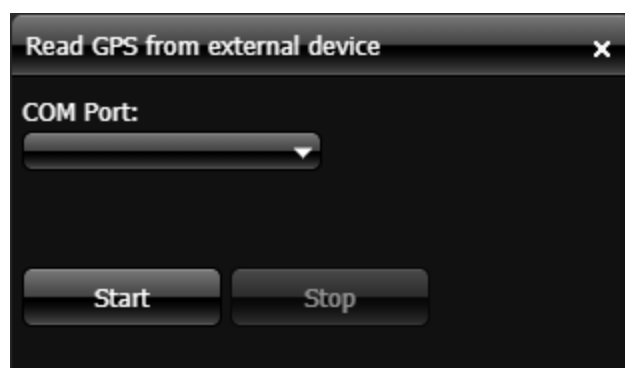
Unit settings dialog box

The **Unit settings** dialog box allows you to configure which campaign date is displayed on the map, and what icon style is used for the unit.

In addition, if it is a GATA field unit, then you can also define whether or not the signal color is displayed on the map, and if an icon is used to display the signal rather than a solid line. You can also select to display the location and appearance of the **Direction finder** pop-up.

> **NOTE**: After any changes are made you must refresh your browser for them to be displayed.
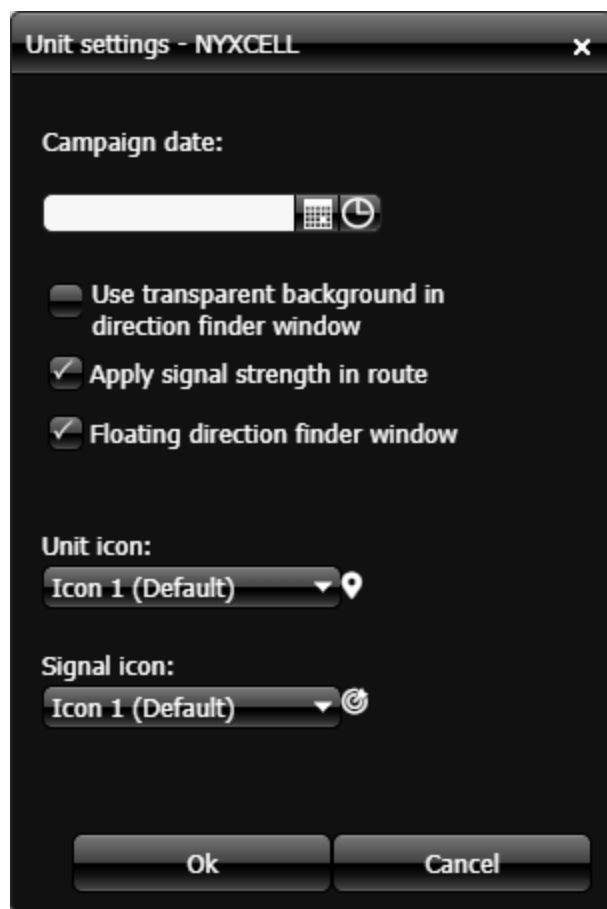
Campaign date

If you have a specific campaign date for the field unit that you want displayed on the map then select the date and time of the campaign.

Note, if you have a date selected in **Apply the date to all selected units? on page 78** then that overrides this setting.

Use transparent background in direction finder window

This setting is only available when the field unit type is GATA.

Click to display the **Direction finder pop-up on page 74** with a transparent background. This allows you to maintain visibility of the map.

Apply signal strength in route

This setting is only available when the field unit type is GATA.

Select if you want to display the signal strength color on the signal trail.

Floating direction finder window

This setting is only available when the field unit type is GATA.

Select if you want to allow the **Direction finder** pop-up to move over the entire **Map on page 60**. If this is not selected then the **Direction finder** pop-up is limited to moving within the field unit tab on the **GATA panel on page 65**.

Unit icon

Select which icon you want used to display the field unit on the map.

Signal icon

This setting is only available when the field unit type is GATA.

If you want to use an icon to display the signal trail then select one from the available options.

3.4.2 Snapshot analysis

The **Snapshot** screen is used to report the results of Snapshot analyses. It is opened from the **Analysis** screen by clicking **Show** for a snapshot analysis.

Examples of the results screen are shown below: In the results you can:

- Click **Export csv file** to export the results for use elsewhere.

- Click the operator link to expand the results and view the detail in a tabular format. This table also allows you to view the neighboring cells.

- Hover over the total channels per technology to view the frequency channels.

Snapshot analyses are also automatically exported to ESPA, where you can review them on ESPA's **Analysis center** screen. For further information refer to the OSS-ESPA Help.

3.4.3 MCLA

The **MCLA** screen is used to report the results of MCLA (Most Common Least Attractive) analyses. It is opened from the **Analysis** screen by clicking **Show** for an MCLA. The **MCLA** screen displays the following:

- MCLA analysis results for each operator and technology

- Option to download the result in the CSV format.

3.4.4 Graph

On the **Graph** screen, the GAR user interface displays data gathered during a collection in graph form.

The GAR user interface displays collection data in the following dashboard types, to make it easier for you to find information relevant to your campaign:

- **Operator**

- **Technology**

- **Frequency Band**

To use a dashboard, click $\equiv$ in the upper-left corner of the wizard screen and select an option from the list.

In the dashboards, the GAR user interface displays data using line graphs and column graphs.

Line graphs display the data gathered for one or more technologies as lines connecting data-points along two axes. The GAR unit allows you to choose from the following types of line graph:

- **Band spectrum**

- **Timeline**

Column graphs display the data gathered for each technology as a separate graph.

If the WiFi feature is licensed on your GAR unit, you can display information about WiFi networks.

Select **WiFi** from the list of technologies, then select either the **2.4 GHz** or the **5 GHz** band to display.

The GAR unit displays the following:

- Column graph of the WiFi networks detected in the band

- Table displaying information about the WiFi networks detected in the band

3.4.5 Grid

On the **Grid** screen, the GAR user interface displays data gathered during a collection in grid form. You can choose from the following options:

- Display a grid showing the data collected for each band as separate rows.

- Display a grid showing layer 3 information for each protocol.

- Display a grid showing information for detected WiFi networks.

  The GAR unit only displays this option if the WiFi feature is licensed.

- Apply group and filter functions to the information in the grid.

  There are a few methods you can use to group records:

  - **Drag a column and drop it here to group by that column**: Use this area, immediately above the column titles, to sort and group records according to the column titles on this panel. Use your mouse to click the column title you want to use to sort your records and drag the title to this area and once a green tick appears in the column title release it with your mouse. You can select multiple column titles to create a hierarchy of grouping, for example the following graphic shows the results grouped by the operator then the frequency:
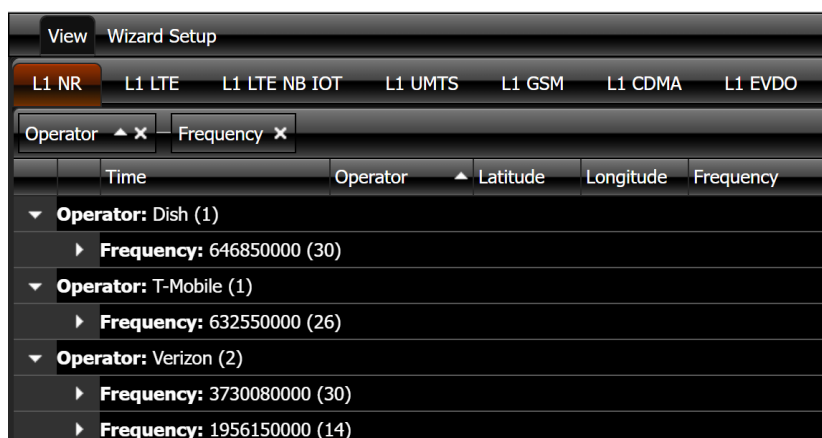
- **Column title menu**: Click the arrow to the right of the column title to display a menu, then click **Group by this column**.
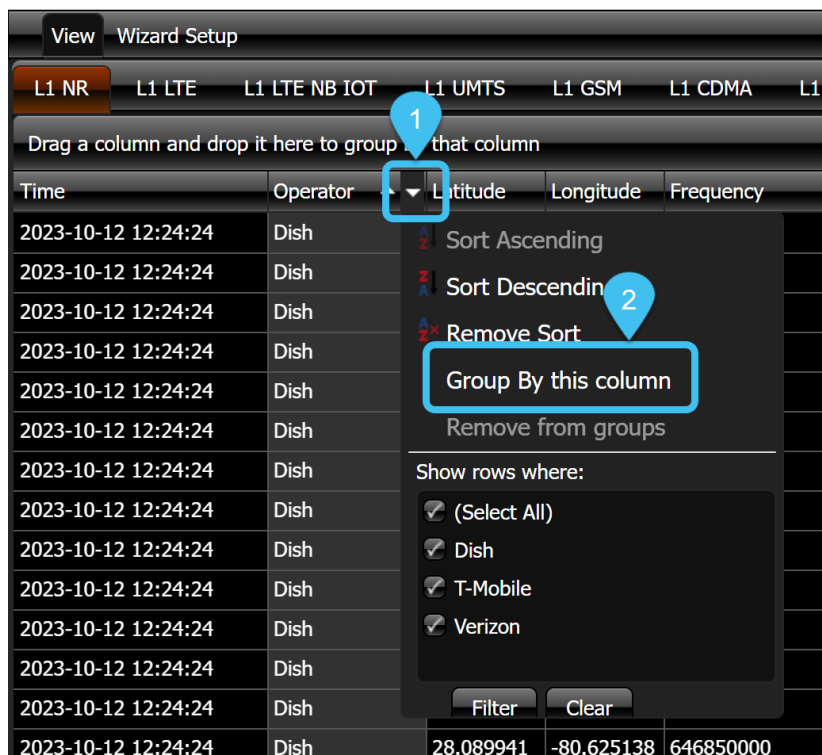
To remove a column header from being grouped, either click the cross in the column title or use **Remove from groups** in the column title menu.

You can also use the column title menu to sort the records in either ascending or descending order, and to filter the rows displayed.

NOTE:When you are analysing data you may want to clear the **Auto-Update** check-box, at the bottom-left of the panel, so that the data is not fluctuating during your analysis.
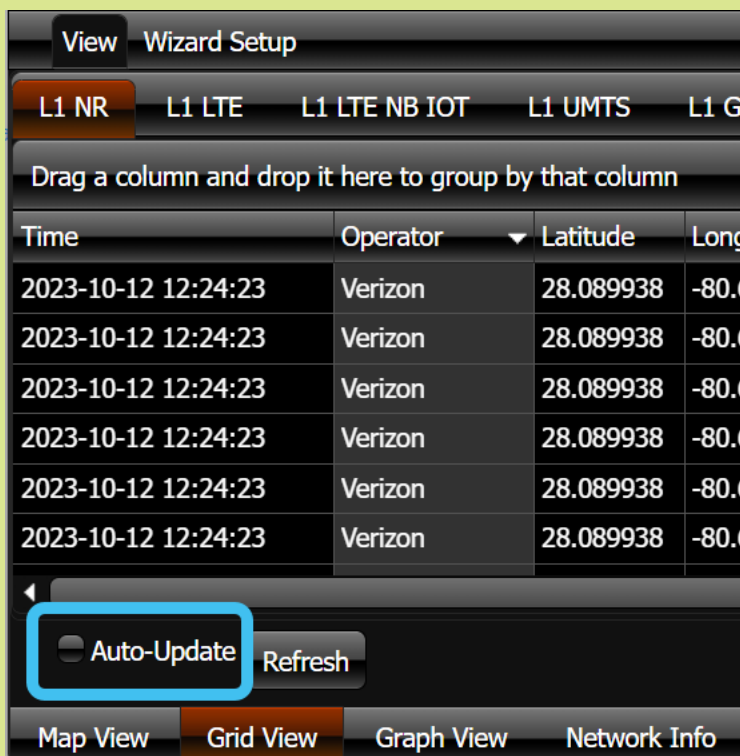
3.4.6 Network Info

The **Network Info** screen displays data and decoded messages for which the source has been identified.

The **Network Info** screen uses the following panels:

- **Selection panel**: displays a tree view of elements which you can surveil and decoded messages which you can display.

  For further information, refer to **Select elements to surveil on page 27**.

  When you select the checkbox for an element, it is added to the surveilled elements panel, and monitored in real time.

  When you select a message, the GAR unit displays the decoded message contents.

- **Surveilled elements**: displays a tree view of surveilled elements, by operator, technology, frequency, channel, and cell.

- **Network and client info**: displays decoded/layer 3 information about an element or a message which you select in the selection panel.

- **Graph**: displays real-time information and historical cell information for surveilled elements, as bar graphs and line graphs.

3.4.7 Device Info

The **Device Info** screen displays information about detected WiFi-enabled devices, for example cell phones and laptops, which are connected to a wireless access point.

The **Device Info** screen lists devices in the following sub-screens:

- **Unassociated**: devices which are broadcasting a WiFi signal detected by the GAR unit, but are not connected to a network through a wireless access point.

- **Associated**: devices which are connected to a detected network through a wireless access point.

- **Stolen**: devices listed as stolen in OSS-ESPA.

To display the location of a device on the **Map** screen, select the device's checkbox.

3.4.8 RF Spectrum

The **RF Spectrum** screen displays the results of an RF spectrum scan, with the following features.

- **Select a band to display RF spectrum data**

   Do one of the following:

   - Select one of the bands from the panels displayed at the top of the screen.

   - Click ≡ in the upper-left corner of the screen and select the required band from the menu.

   The received RF power for the band is displayed as a line graph in the main view.

- **Zoom into a range on a selected band**

   In the **Frequency** bar at the bottom of the screen, highlight a range between two frequencies by clicking and dragging the cursor.

   The received RF power for the selected range is displayed in the main view.

   To display the entire band again, click **Reset**.

- **Identify the Technology or Operator broadcasting at different ranges of a band**

   In the dropdown menu in the upper-right corner of the screen, select one of the following:

   - **Spectrum only**

      Displays the band without Technologies or Operators identified.

   - **Technology bands**

      Displays the band with different ranges color-coded by Technology.

   - **Operator bands**

Displays the band with different ranges color-coded by Operator.

- **Oper/Tech bands**

Displays the band with different ranges color-coded by Operator and Technology.

You can configure the bands used in the RF spectrum scan in the **Edit RF Spectrum Bands** dialog, accessed from the **Current Configuration** screen.

For further information, refer to **Edit RF Spectrum Bands on page 94**.

3.5 Analysis

The **Analysis** screen displays current and previous analyses run on the collected cellular coverage data. You can open an analysis to display its results after it has completed.

The **Analysis** screen displays the following information for each analysis:

- **Type**: type of analysis, for example, `MCLA`

- **Description**: displays the type of snapshot analysis, either By files or By location

- **Name**: unique identifier of the analysis

- **Status**: progress of the analysis

- **Progress**: current state of the analysis, for example, `Execution is finished` if the GAR unit has finished running the analysis

- **Result**: whether the analysis was completed successfully

- **Requested**: date on which the analysis was requested

- **Started**: date on which the analysis was conducted

Controls are also available for each analysis:

- **Cancel**: click to cancel a running analysis

- **Delete**: click to delete the results of an analysis

- **Show**: click to display the results of the analysis in a new screen

- **Action**:

  - **Run Alert/Cancel Alert**: click to run or cancel an alert on missions deploying 24x7 scenarios or VIP routes. Create a base line with the **Snapshot analysis on page 83** after collecting data and then configure it to detect any new cell tower from the base line. This type of alert is useful for VIP route monitoring and other scenarios if you want to check if the VIPs are being monitored.

  - **Download**: in addition to being able to open the base station location analysis on the map you can also click to download the results.

Additional controls are available at the foot of the **Analysis** screen to update the display. Click **Refresh** to update the analysis results, or select the **Auto-Update** checkbox to automatically update the analysis results in real time.

3.6 Summary screen

After a collection has been completed or if you have stopped the collection, the GAR user interface displays the **Summary** screen.

The **Summary** screen displays the following:

- Information about the collection drive.

- All operators identified in the discovery scan.

- Options to **Shutdown unit** or **Re-start collection**.

> **NOTICE**: You must stop cellular coverage data collection before you shut down the unit.

3.7 Logs and Settings

The GAR user interface displays information about the status of the GAR unit in the **Logs and Settings** screens.

To access these, click **Logs and Settings** in the upper-right corner of the drive run wizard screens.

The following **Logs and Settings** screens are available:

- **GAR Log**: displays the GAR management software status, and triggers an alert if there are issues with the GAR unit.

- **Rx Log**: displays the receiver's current status and triggers an alert if there are issues with the receiver.

- **Upload Log**: displays the status of the collected files as they are uploaded to the OSS-ESPA server, and triggers an alert if there are issues uploading any file.

- **Current Config**: displays the settings for the current collection drive, and provides options to change some of the GAR unit's operational settings.

    For further information, refer to **Current Configuration on page 92**.

- **Data Manager**: displays data files used by the GAR unit.

    In this screen, you can move files between different directories, for example, to copy data onto a USB pen drive or hard drive connected to the GAR unit.

3.7.1 Current Configuration

The **Current Configuration** screen displays the settings for the current collection drive.

To clear campaign information, set the GAR unit to **Idle**, then select **Clear Current Configuration** in the **Current Configuration** screen.

The **Current Configuration** screen provides the following options to change some of the unit's operational settings:

- Configurable tree view of the operators, technologies, and bands to be included in the collection.

    To remove an item from the collection, clear the checkbox.

- **Campaign start date**: Start date of the campaign. The GAR unit uses this to manage its autonomous start process, and to display campaign drive route information in the **Map** screen.

- **Unit start delay time**: Time which the GAR unit waits for the user to connect using the web browser, and select tasks. If the user does not connect within this time, then the unit automatically starts a cellular coverage data collection with discovery.

    If the **Campaign start date** is set, then the GAR unit starts the collection using the existing drive configuration.

    If the **Campaign start date** is not set, then the GAR unit starts a new discovery scan.

    The default setting is `120` seconds.

- **Discovery duration**: Length of time which the GAR unit spends running a discovery scan.

    Available values are from `0` to `30` minutes. If set to `0`, the discovery scan runs without stopping.

- **File size**: Size of the file in which the GAR unit stores data for upload to OSS-ESPA. When the collection data exceeds this, the GAR unit creates a new file to store the additional data.

  Available values are from `0` to `200` MB. If set to `0`, there is no restriction on file size.

- **File duration**: Collection time period for which the GAR unit stores data in a single file. For example, if this is set to `20` minutes, the GAR unit stores all data collected in `20` minutes in a single file.

  Available values are from `0` to `60` minutes. If set to `0`, there is no restriction on file duration.

  If **File duration** and **File size** generate conflicting file sizes, the GAR unit uses the smaller file size.

- **Navigation mode**: allows you to select how the GAR unit records location information for collections. You can select from the following modes:

  - **GPS**: The GAR unit records location information using GPS.

  - **Indoor**: The GAR unit requires you to manually enter coordinates during a collection using the **Map** screen.

    This is useful if you are running a collection in locations where there is no GPS signal, or where the GPS signal is weak, for example inside a building.

  - **Indoor+GPS**: The GAR unit requires you to manually enter coordinates in the same way as **Indoor** mode. However, the GAR unit displays the current GPS location when it detects a GPS signal, to help you enter an accurate location.

  The default setting is **GPS**. This setting can only be configured when the GAR unit's status is **Idle**.

- **WiFi collection**: allows you to enable or disable the collection of WiFi data during a collection drive.

  The GAR unit only displays this option if the WiFi feature is licensed.

  The default setting is **Enabled**.

- **RF spectrum scan**: allows you to enable or disable the collection of RF spectrum data during a collection drive. You can select from the following modes:

  - **None**: the GAR unit does not scan the RF spectrum.

  - **Automatic**: the GAR unit scans the RF spectrum for all the bands identified during the discovery.

  To edit the bands used in the RF spectrum scan, click **Edit**.

  The **Edit RF Spectrum Bands** dialog opens.

  For further information, refer to **Edit RF Spectrum Bands on page 94**.

- **Automatically upload log files**: allows you to backup GAR log files from the queued folder of the GAR Data manager.

  The default setting is **Enabled**.

- **Audio warning on lost connection**: when enabled a beep is sounded if there is a loss of connection with the GAR portal server meaning the UI is not being updated.

- **Send live GPS to ESPA**: when enabled your GPS location is sent to OSS-ESPA. This allows other personnel to view and track your location. The GPS information may either be from a GAR unit, an OTA field unit, or an external GPS device that you have selected using the **Read GPS from external device dialog box on page 79** .

- **GATA**: when enabled the Gladiator Automated Target Acquisition feature is available to use. For further information refer to **About Gladiator Automated Target Acquisition (GATA) on page 7** and **Using GATA on page 36**.

- **Reset Options...**: opens a dialog giving you the following options to reset the GAR unit:

  - **Reset GAR state to IDLE**: sets the GAR unit's receiver status to **Idle**.

    For further information, refer to **Status on page 57**.

  - **Restart GAR software**: opens a confirmation dialog giving you the option to restart the GAR unit's software.

  - **Restart GAR computer**: opens a confirmation dialog giving you the option to restart the GAR unit.

Edit RF Spectrum Bands

The **Edit RF Spectrum Bands** dialog allows you to configure the bands used in the RF spectrum scan.

You can access the **Edit RF Spectrum Bands** dialog from the **Current Configuration** screen.

For further information, refer to **Current Configuration on page 92**.

You can do the following:

- **Select an existing band to include in the RF spectrum scan**

  To include a band, select it using the tree view.

  To include all bands in the RF spectrum scan, click **Select All**.

  To exclude all bands from the RF spectrum scan, click **Clear All**.

- **Create a new band**

  Click **Add Band**, and enter the **Band name**, **Lower frequency**, and **Upper frequency**, then click **OK**.

  The new band is displayed in the tree view under **User bands**.

- **Change the name or frequency range of an existing band**

  Click **Edit Band**, and update the **Band name**, **Lower frequency**, and **Upper frequency**, then click **OK**.

4 Specifications

The GAR unit collects a wide range of cellular coverage data and is designed to be operated easily and safely in indoor and outdoor conditions.

The following sections provide details of the GAR unit specifications.

4.1 Bands

The GAR unit uses a number of filters to scan cellular coverage data. Each filter scans a single band. More than one filter can scan the same band.

The range of filters your GAR unit can use depends on how the GAR application is licensed.

- **Software Defined Radio (SDR) technology**: you can configure the GAR unit to scan any technology for a band defined by an appropriate authority, such as ETSI or 3GPP.

- **Frequency range**: 350 MHz - 6 GHz, and 17 GHz to 53 GHz

Bands supported by the GAR unit:

- **NR - 3GPP TS 38.101-1**

    - **3GPP Portal Specification #: 38.101-1**:
      https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3283

    - **Wikipedia 5G NR Frequency Bands**: https://en.wikipedia.org/wiki/5G_NR_frequency_bands

- **LTE and NbIoT – 3GPP TS 36.101**

    - **3GPP Portal Specification #: 36.101**:
      https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2411

    - **Wikipedia LTE Frequency Bands**: https://en.wikipedia.org/wiki/LTE_frequency_bands

- **UMTS - 3GPP TS 25.101 and 25.102**

    - **3GPP Portal Specification #: 25.101**:
      https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=1151

    - **3GPP Portal Specification #: 25.102**:
      https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=1152

    - **Wikipedia UMTS Frequency Bands**: https://en.wikipedia.org/wiki/UMTS_frequency_bands

- **CDMA/EvDO - 3GPP2 C.S0057-E**

    - **3GPP2 Portal specification C.S0057-E** https://www.3gpp2.org/Public_html/Specs/C.S0057-F_v1.0_Republication_20150915.pdf

    - **Wikipedia CDMA Frequency Bands**: https://en.wikipedia.org/wiki/CDMA_frequency_bands

- **GSM - 3GPP TS 45.005**

    - **3GPP Portal Specification #: 45.005**:
      https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2709

    - **Wikipedia GSM Frequency Bands**: https://en.wikipedia.org/wiki/GSM_frequency_bands

- **WiFi**

    - **IEEE Explore 802.11 Standard**: https://ieeexplore.ieee.org/document/9363693

    - **Wikipedia List of WLAN Channels**: https://en.wikipedia.org/wiki/List_of_WLAN_channels

4.2 Protocols

The GAR unit supports the following protocols:

- GSM

- WCDMA

- CDMA/CDMA2000®

- 1xEV-DO (Rel. 0/Rev. A/Rev. B)

- LTE-FDD

- LTE-TDD

- WiFi (802.11 A/B/G/N/AC)

- NR

- NB-IoT

4.3 Metrics

The GAR unit has the following dimensions.

In this data the GAR unit includes the GPS/RF/WIFI cables and antennas, and two scanners. Each scanner weighs 0.5 kg (17.63 lbs).

GAR unit with suitcase dimensions:

Measurement	Metric	Imperial
Height	54.5 cm	21.45 "
Length	24.5 cm	9.64 "
Width	34.5 cm	13.58 "
Weight	19.36 kg	42.7 lbs

GAR unit without suitcase dimensions:

Measurement	Metric	Imperial
Height	18.5 cm	7.28 "
Length	27 cm	10.62 "
Width	42 cm	16.53 "
Weight	14.37 kg	31.7 lbs

4.4 Power

The GAR unit has the following power specifications:

- Input voltage range: 10 to 18V DC (-0%/+10%)

- Nominal input current: maximum 8A at 10V

- Typical battery life when conducting 32 tasks: 4 hours

The GAR unit is powered by one of the following methods:

- Cigarette lighter power cable

- GAR unit batteries

  You can recharge batteries using the wall unit.

  1 battery takes 4 hours to fully charge.

GAR unit batteries are hot swappable, so you can swap a depleted battery with a fully charged replacement without switching off the unit.

> **CAUTION**: When connecting the GAR unit to a power supply, only use the power adapter which is supplied with the GAR unit. Do not use any other power adapter.

4.5 Environmental specifications

The GAR unit is designed to be robust and operates in a range of indoor and outdoor conditions.

GAR unit environmental specifications:

Environmental factor	GAR specifications
Operating temperature	+5°C to +40°C (+41°F to +104°F)
Permissible temperature	0°C to +45°C (+32°F to +113°F)
Storage temperature	-20°C to +50°C (-4°F to +122°F)
Damp heat	+40°C (+104°F), 95% relative humidity, cyclic In line with EN60068-2-30
Sinusoidal vibration	In line with EN 60068-2-6
Random vibration	In line with EN 60068-2-64
Shock	In line with MIL-STD-810E, method no. 516.4, procedure 1
Electromagnetic compatibility	In line with EMC Directive 2004/108/EC, applied harmonized standards: EN 61326-1 (industrial environment) EN 61326-2-1 EN 55011 (class B) EN 61000-3-2 EN 61000-3-3 EN 50498
Electrical safety	In line with EU Directive 2014/35/EU EN 61010-1

4.6 Regulatory

The GAR unit complies with the following regulations:

- RoHS product Category 9 for monitoring & control instruments

- IEC 60950-1 safety standard, when using the GAR power adapter

- VDE-GS mark of safety approval, certificate no. 40039189