



## TargetTrack 4

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Version	Date	Comments
-	1/31/2026	Initial Release

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# 1. Disclaimer

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## 2. Glossary

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Below are definitions used in this document

- **Beacon:** A radio transmission source at a known location, transmitting on a known frequency.
- **Fixed Site:** A direction finder located at a fixed location.
- **Intercept:** Receipt of a transmitted signal by a direction finder.
- **Line of Bearing (LOB):** Azimuth angle measured from true north from the site of the direction finder to a transmission site (also referred to as a bearing).
- **Mission:** Settings and parameters in TargetTrack 4 that define the operation of the application
- **Mobile Site:** Direction finder mounted in a vehicle or vessel.
- **Primary Site:** Site that controls the data collection. Audio from the primary site will be recorded and saved in the database.
- **Target:** Estimated location of a radio frequency transmission source
- **Reception:** Combination of all intercepts upon receipt of a signal. If only one site is in use the reception consists of only one intercept. The reception entered in the database contains the date, time, frequency of the reception as well as meta data entered by the user.

# 3. Introduction

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TargetTrack 4 provides geolocation of radio transmission sources using Doppler Systems, LLC radio direction finding hardware. Using an IP network, the software connects to multiple radio direction finders located in a geographical area. When a radio transmission occurs, the direction finders measure bearings to the transmission source. TargetTrack 4

- Works with fixed sites and mobiles
- Facilitates data collection and control of remotely connected direction finders
- Draws the bearings on a map based display
- Calculates and displays the estimated position of the transmission source
- Records and plays the received audio from the transmission source (target)
- Saves the bearings and recorded audio to a searchable database for later retrieval and playback
- Allows user to define the anticipated geographical area of the transmission source to limit the amount of data collected when monitoring busy channels
- Provides user defined search and scan functions allowing monitoring of a range of frequencies.

## 4. Getting Started

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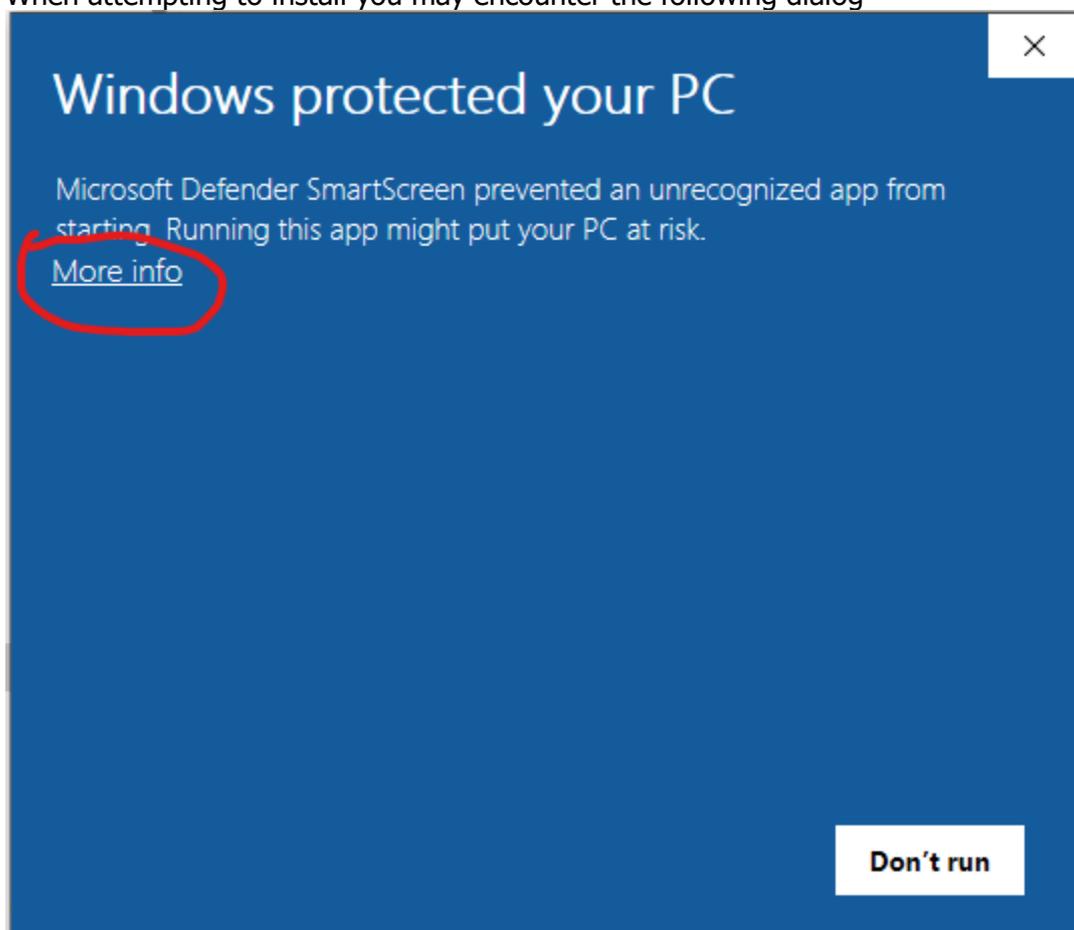
### 4.1. Installation

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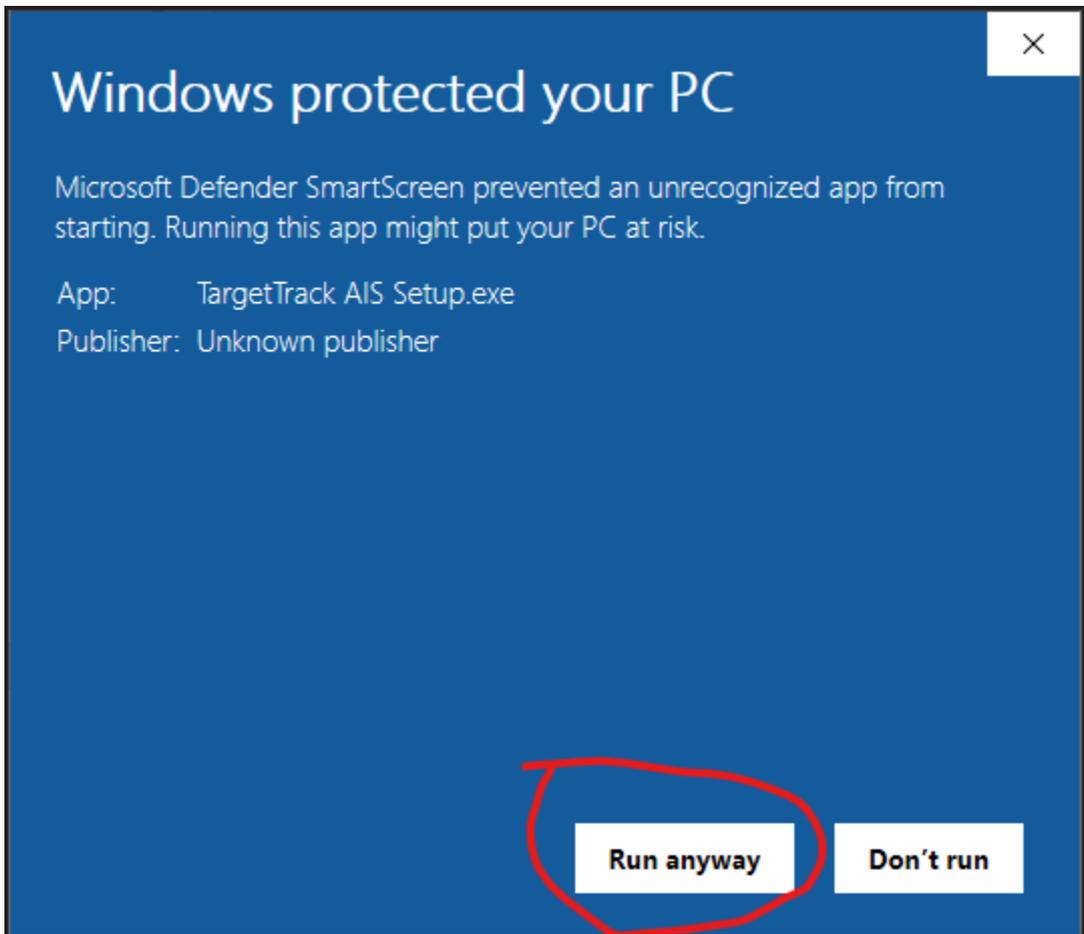
To install TargetTrack 4 double click on TargetTrack 4.exe and follow the on screen instructions. The latest version of TargetTrack 4 is always available from our web site

<https://dopsys.com/radio-direction-finder-software/direction-finder-downloads/>.

When attempting to install you may encounter the following dialog



If you do, press the More info link as shown above and the dialog will change to



Then press Run anyway as shown above.

---

#### Minimum Computer Requirements of Computer

Operating System	Windows 10 or higher
Minimum Available Disk Space	50MB
Installed RAM	2 GB
Ethernet	100BaseT
Audio	Speaker or Headphones

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## 4.2. License

TargetTrack 4 requires a license key. If you purchased the software with your direction finder you should have been furnished with a key. If you do not have the key, contact the factory at [Doppler Systems](http://Doppler Systems), or call 1-480-488-9755. Each license will license up to five instances of TargetTrack 4. The license is typically good for one year. Thirty days prior to expiration, the user will be alerted that license renewal is required. If the license is not renewed, there is a thirty day grace period. After the grace period expires, TargetTrack 4 will no longer run.

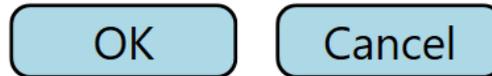
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### 4.2.1. Activating aLicense

The first time you run the TargetTrack 4 a license dialog will appear as shown below

## License Key Entry

Please enter your license key:

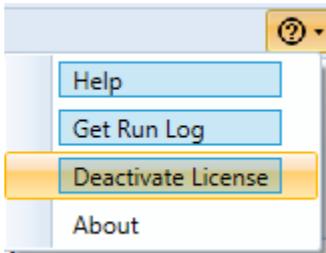


Enter the license key and click OK. If the license key was entered incorrectly the program will exit.

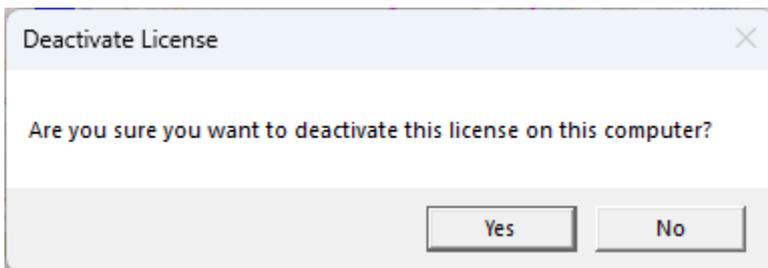
## 4.2.2. Deactivating A License

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The TargetTrack 4 license entitles the user to license up to 5 computers running TargetTrack 4. If this maximum number has been reached and you would like to license another computer it is necessary to deactivate the license on one computer. To deactivate a license, select Deactivate License from the Help Menu.



Click Yes on the displayed dialog and the license will be removed from the computer.

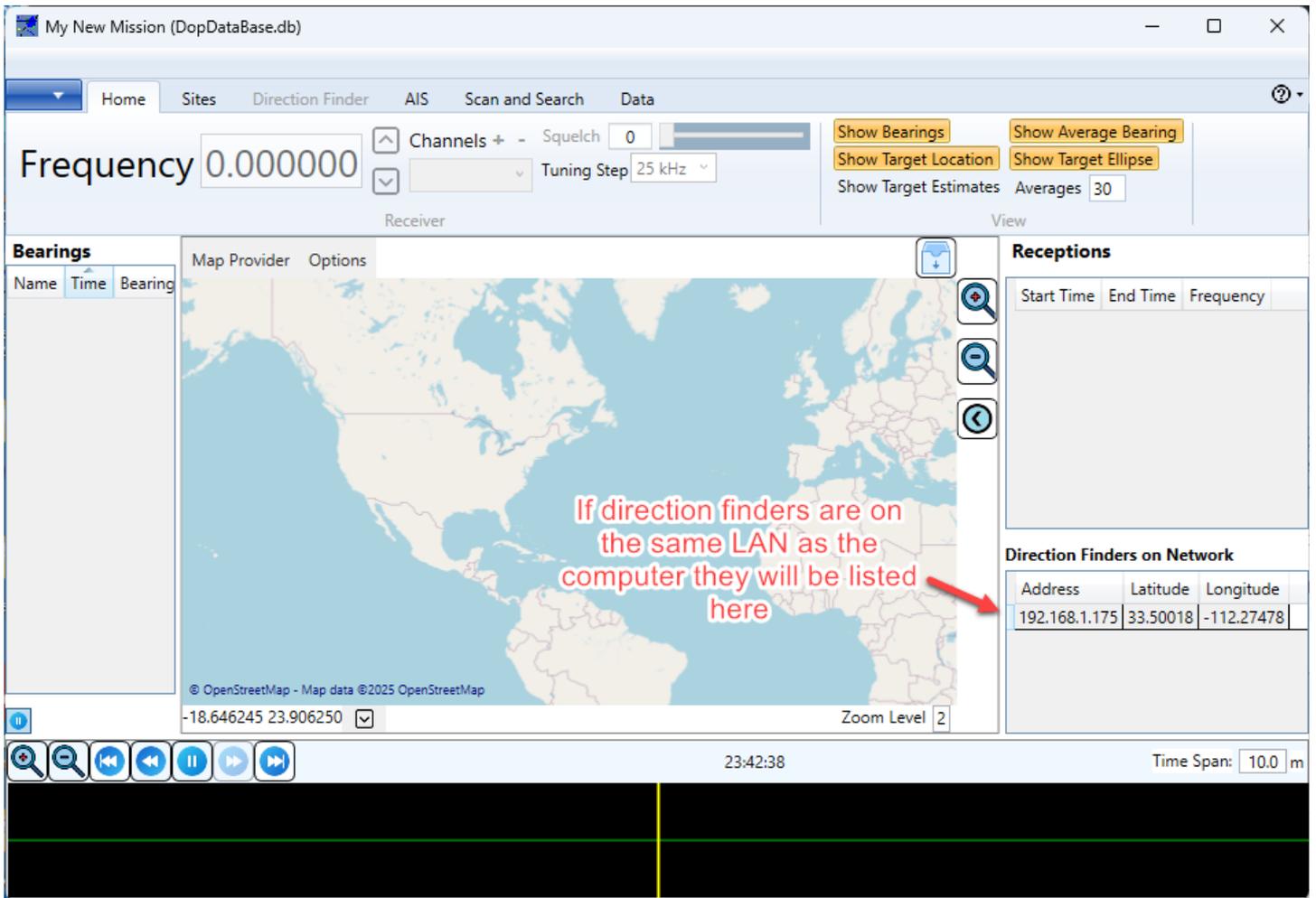


Once deleted, you can move the license to another computer.

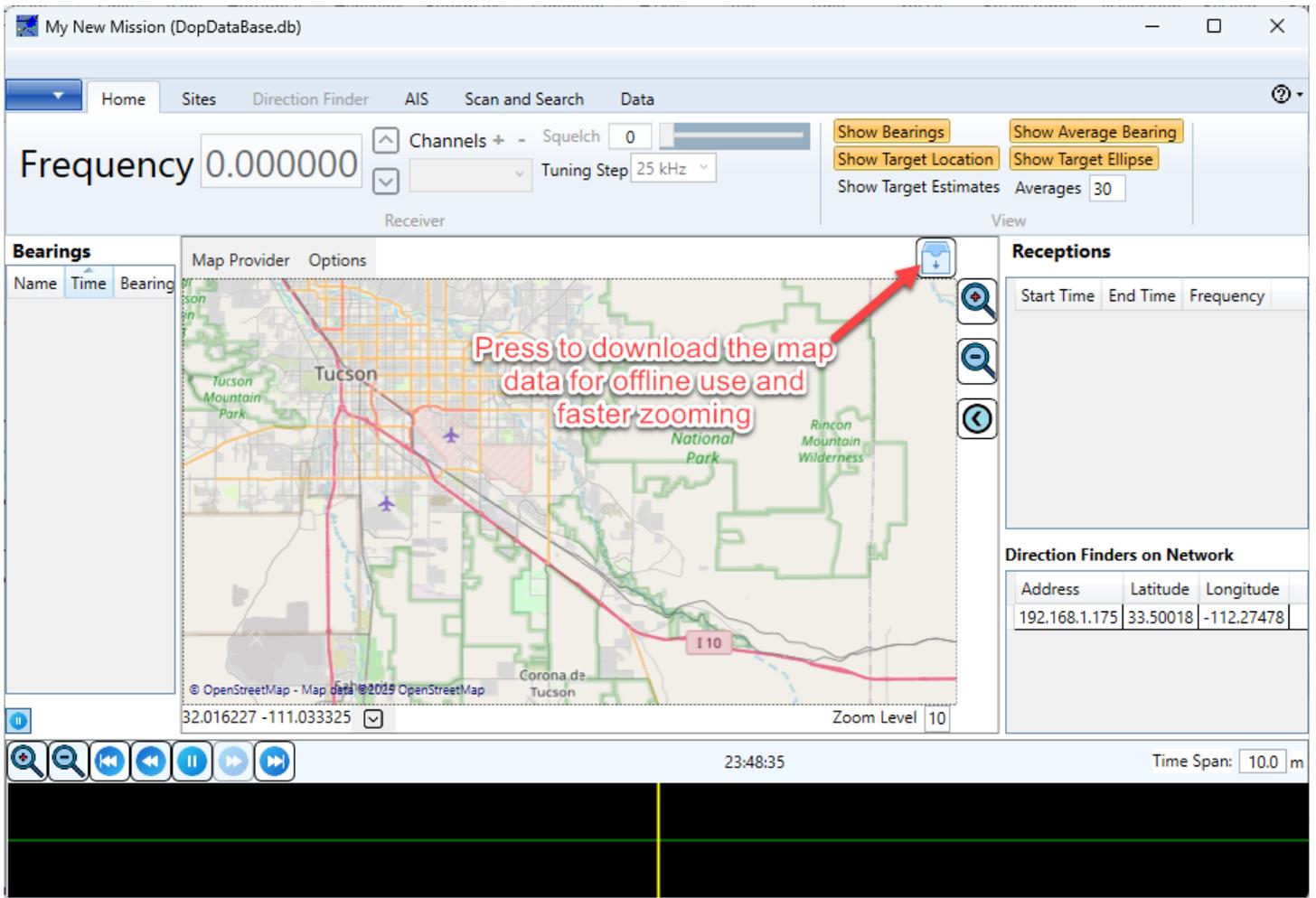
## 4.3. Map

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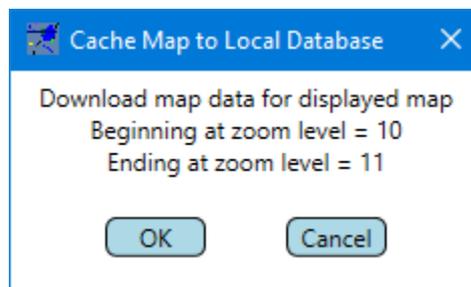
The first time TargetTrack 4 is run, the display will be similar to what is shown below. A world map will be displayed. If there are any direction finders that are directly connected to the computer or if they are on the same local area network as the computer their address and location will be displayed in the lower right hand corner of the screen. **Note: The first time you run TargetTrack 4 the computer you are using must have an Internet connection.**



Next use the Zoom and Pan controls to select the geographical area where you are going to use your Doppler radio direction finders. Pan the map by positioning the mouse on the map and pressing the left mouse button. While holding the left mouse button down move the mouse up or down or to the right or left. The map will pan with the motion of the mouse. The arrow keys can also be used to pan the map. Press the Zoom In button to zoom in on the area you wish to use. You can also use the mouse wheel to zoom in and zoom out the map. The screen shot below shows the map zoomed into the Tucson area.



Once the map is positioned press the Download Map Data button in the upper right corner of the map. A dialog similar to the one shown below will be displayed. Press OK and the map data will be downloaded and saved to your hard disk. This will allow for faster zooming in the future as well as allowing the map to be used off line if required.



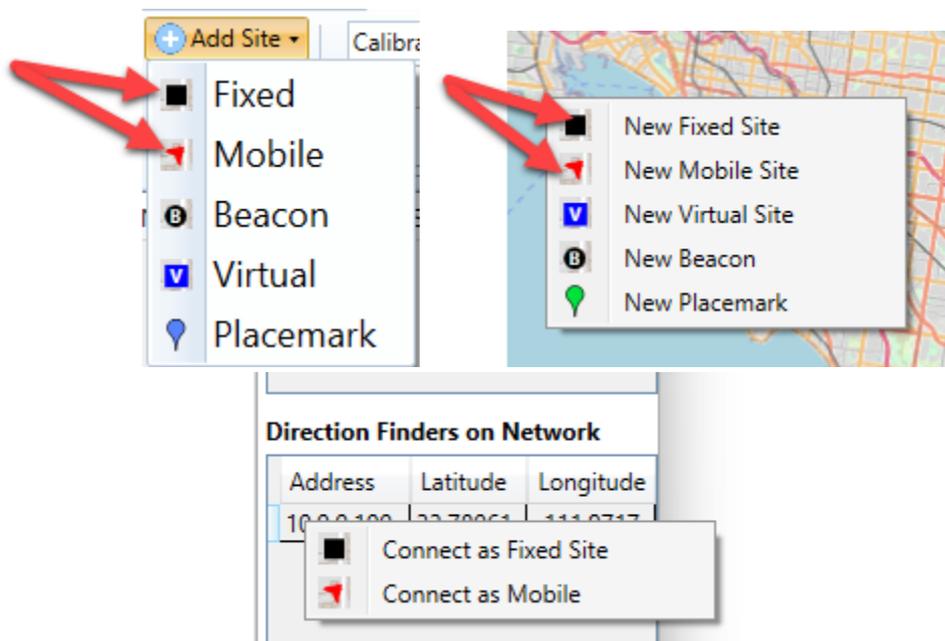
## 4.4. Adding Direction Finding Sites

TargetTrack 4 requires that the location and IP addresses of the direction finders must be entered into the application. There are two types of direction finder entries: fixed site and mobile. Repeat the steps given below for each direction finder on your network.

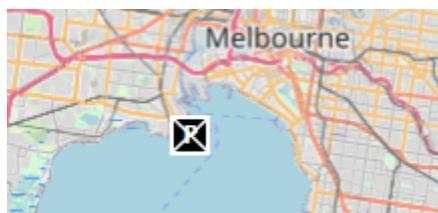
To add a site to TargetTrack 4, either click on the Sites tab in the ribbon menu and select Fixed or Mobile from the Add Site menu or right click on the map at the location where you want to place the site and select New Fixed Site or New Mobile Site from the pop up menu.

If the direction finder is on the local area network you can right click on the table at the bottom right of the screen and select Connect as Fixed Site or Connect as mobile. The site will be automatically created and placed

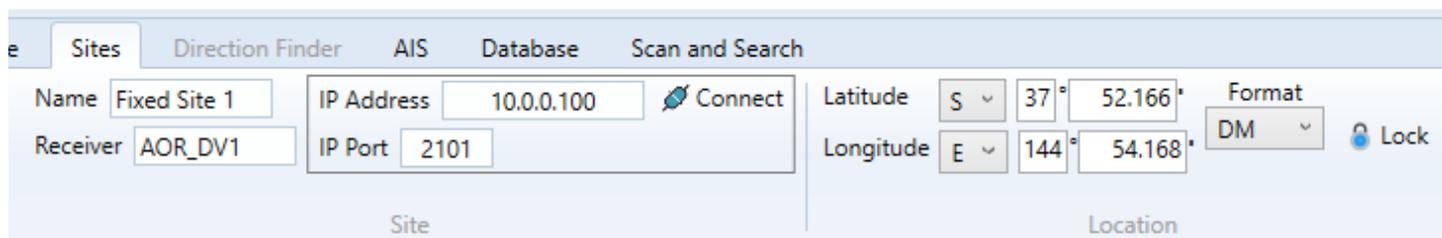
at the proper location on the screen.



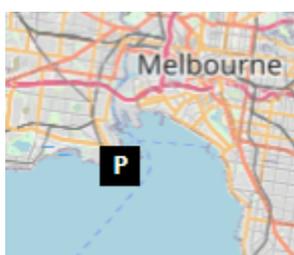
The site will appear on the map as shown below. If it is in the wrong location you can left click on the site and drag it to the desired location or you can enter the coordinates of the site on the Sites tab of the ribbon menu. If your direction finder has a GPS then the site will be properly positioned once a connection with the direction finder is established.



Click on the Sites tab on the ribbon menu and enter the name of the site and the IP address and IP Port. Unless you have changed the IP port using MPT User Interface it will be 2101.



Click on the Connect button and if the data entered is correct and the direction finder is on the network, the site will appear as shown below.



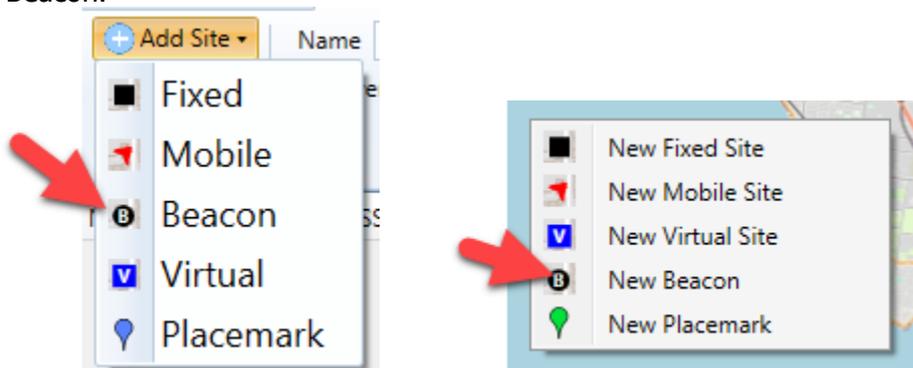
You change the size of the site and the color of it by left clicking on the site and selecting Size and Color on the Sites tab of the ribbon menu. If you hear static in the speaker and you are not tuned to a signal source increase the squelch setting on the Home tab to eliminate the noise.

If you are not using a GPS with the direction finder, it is recommended that you next press the lock button for the site. This will prevent the accidental repositioning of the site. If you need to move the site you can press the button again to unlock it.

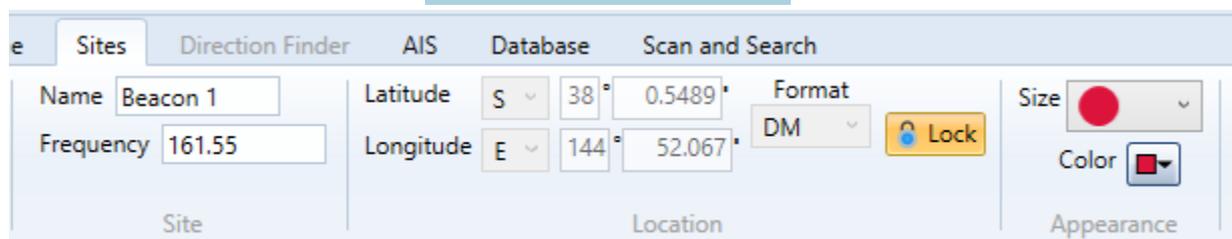
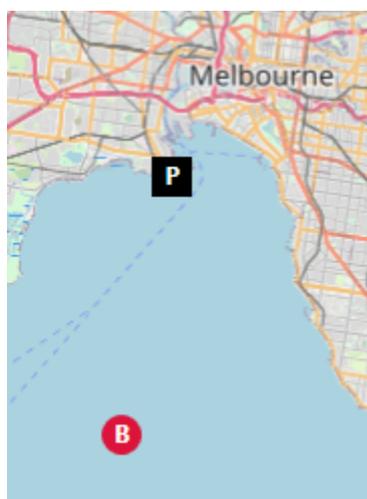
## 4.5. Calibrating a Fixed Site Direction Finder

Each fixed site direction finder must be calibrated prior to using it. Calibration requires a radio frequency transmission source at a known frequency and location referred to as a Beacon. If the direction finder is going to be used over a limited angle it is best to use a beacon near the center of the desired range of bearings.

To place a beacon on the map select Beacon from the Add Site menu on the ribbon menu or right click on the map and select New Beacon.

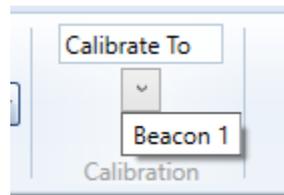


Position the beacon on the map by left clicking on the beacon icon and dragging it to the desired location. On the Sites tab enter the name of the beacon and its frequency.

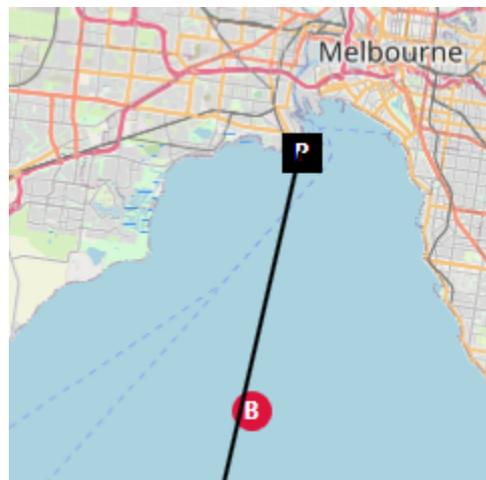


Press the Lock button to avoid accidentally moving the beacon at a later time.

Once the beacon is positioned click on the site you wish to calibrate and select the beacon you want to calibrate to from the Calibrate To drop down menu.



The software will tune the receiver to the frequency of the beacon and then perform the calibration. It is best to tune the receiver to the beacon frequency to check the calibration. If the calibration is not correct repeat it. The figure below shows the display of a calibrated site



## 4.6. Mobile Direction Finder

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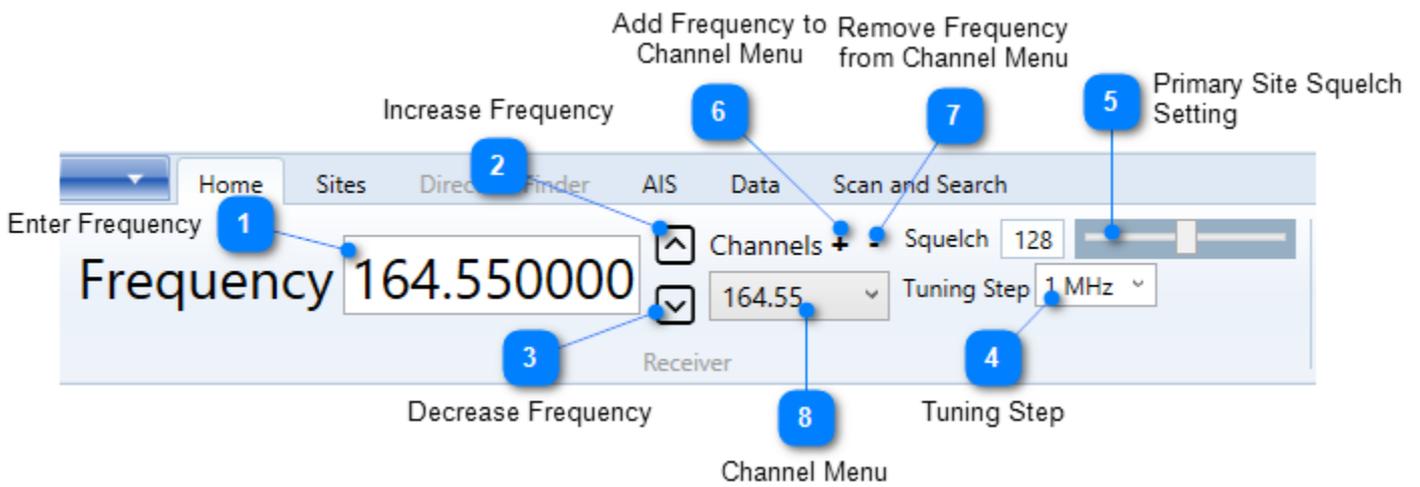
Use the exact same procedure as shown above to add a mobile site to the map. However, there is no need to calibrate a properly installed mobile. The mobile system is factory calibrated.

Once the mobile site is added to the map it is necessary to drive in a straight line for about 20 meters in order for the GPS receiver to establish a heading.

## 4.7. Setting the Frequency

---

To tune the direction finders to the desired frequency, select the Home tab on the ribbon menu. The frequency can be entered by typing in the desired frequency or by pressing the increase frequency or decrease frequency buttons. All of the direction finders on the network will be set to the same frequency.

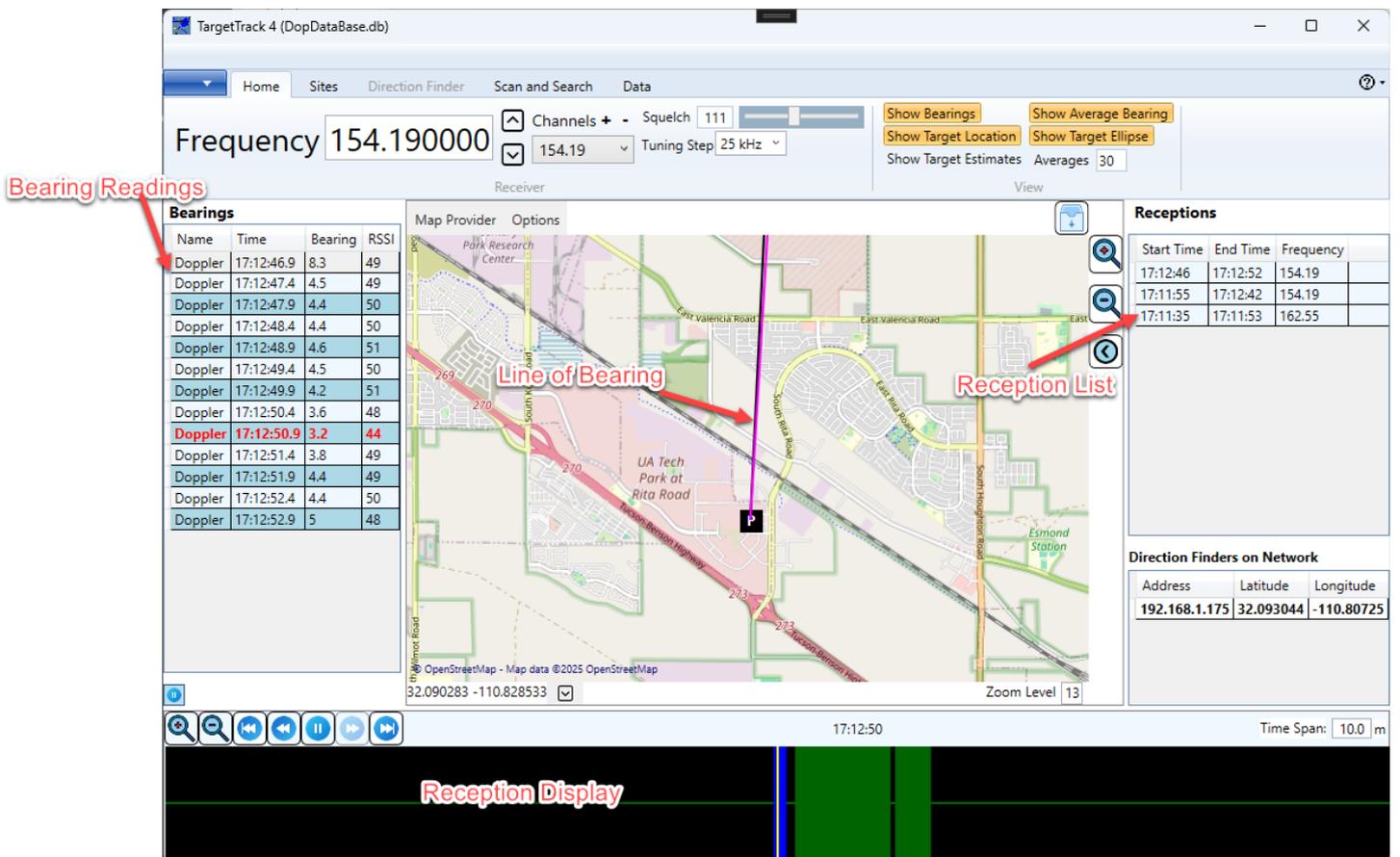


- **1 Enter Frequency**  
Type in the desired direction finding network frequency in MHz
- **2 Increase Frequency**  
Pressing this button increases the frequency by the tuning step.
- **3 Decrease Frequency**  
Pressing this button decreases the frequency by the tuning step
- **4 Tuning Step**  
Use this drop down to adjust the tuning step
- **5 Primary Site Squelch Setting**  
Sets the primary site's receiver squelch
- **6 Add Frequency to Channel Menu**  
Press + to save the currently tuned frequency to the Channels menu
- **7 Remove Frequency from Channel Menu**  
Press - to remove the channel displayed in the Channel menu from the Channel menu
- **8 Channel Menu**  
Select a channel to tune the receiver to.

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## 4.8. Receiving a Bearing

When a signal is received by the Primary site receiver bearing lines will be drawn on the map and the intercept display will show that a signal is being received. The figure below is an example of a received bearing.

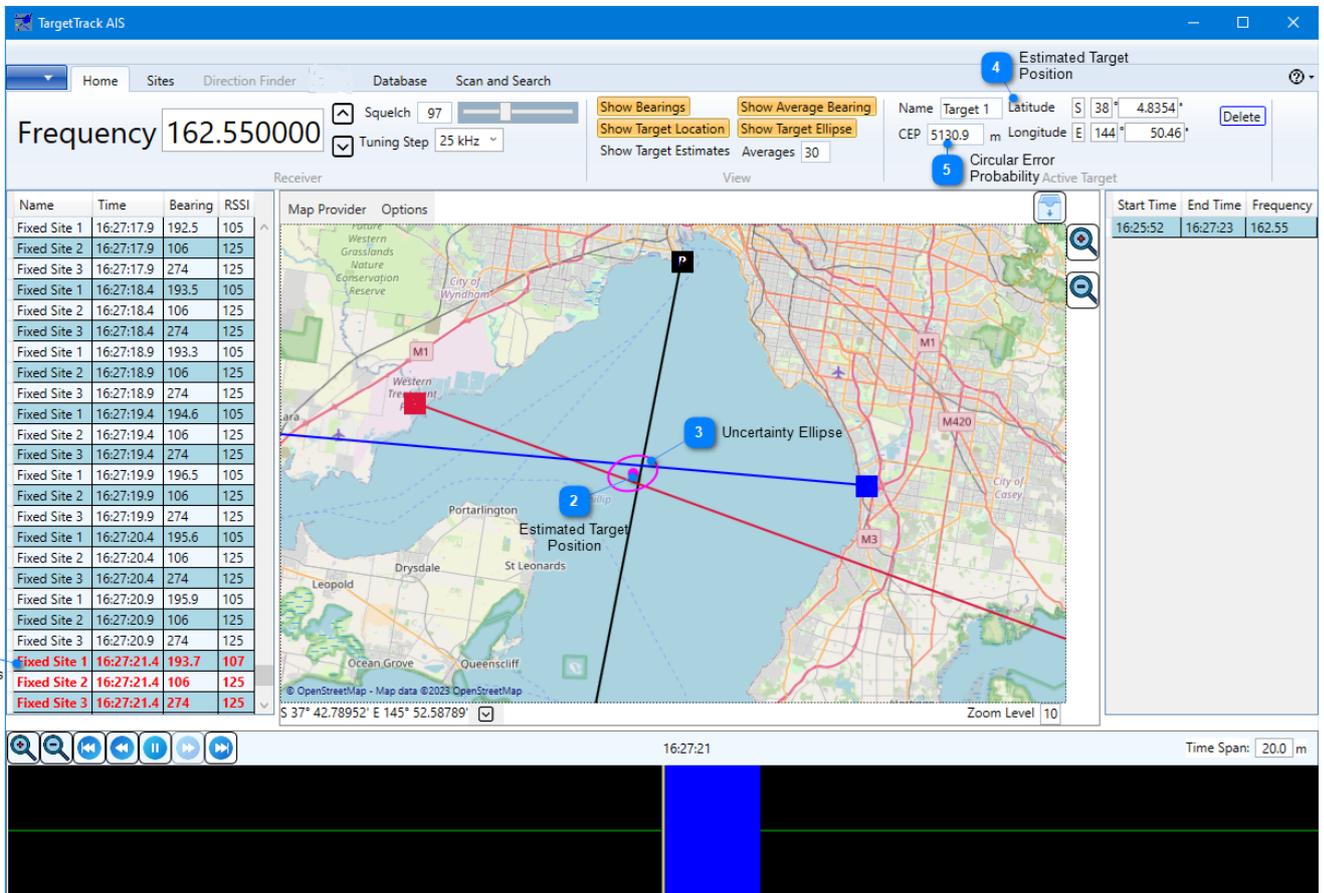


## 4.9. Geolocating a Transmission Source

Geolocating a transmission source requires at least two and preferably three or more radio direction finders located in the area of the transmission source. The [Site Location for Optimal Triangulation](#) application note discusses the siting of direction finders for optimal triangulation. Obviously due to location restrictions the optimal locations cannot be achieved, however, the application note can be used to provide guidance on locating the radio direction finders.

Prior to performing geolocation, add the direction finders to be used onto the map as described in [Adding Direction Finding Sites](#) and calibrate the added sites per [Calibrating a Fixed Site Direction Finder](#).

Once all the sites are connected and calibrated, tune the direction finder to the desired frequency. When a transmission occurs, the display will resemble the one shown below.



### Displayed Bearings

Bearings from each site that are currently shown on the display

### Estimated Target Position

Estimate position of the transmission source

### Uncertainty Ellipse

Ellipse indicating that the target has a 95% probability that it is within this elliptical area

### Estimated Target Position

Coordinates of the estimated target position

### Circular Error Probability

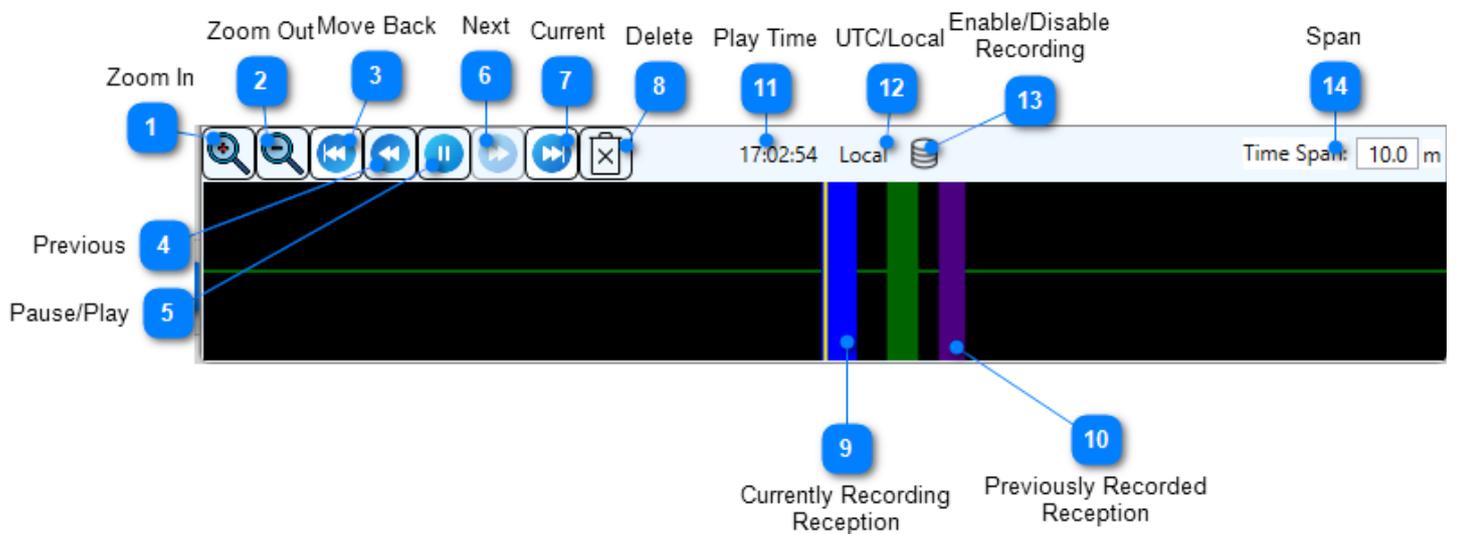
Radius of a circle around the target that predicts target has a 95% probability that it is within this radius about the estimated target position

## 4.10. Playback of Recorded Reception

Each time the direction finders receive a signal, a reception is created and entered into a database. The recorded receptions can be accessed using the reception controls or by searching the database.

### 4.10.1. Reception Control

The reception control appears at the bottom of the display. Explanations of each controls functions are given below.



- 1
**Zoom In**  
 Halves the time span of the display  

- 2
**Zoom Out**  
 Doubles the time span of the display  

- 3
**Move Back**  
 Repositions the time back 1 hour  

- 4
**Previous**  
 Plays the previously recorded reception  

- 5
**Pause/Play**  
 Pauses or resumes the playback of the data  

- 6
**Next**  
 Plays the next recorded reception  

- 7
**Current**  
 Moves the time to the current time  

- 8
**Delete**  
 Deletes the selected reception  

- 9
**Currently Recording Reception**  
 Displays the currently recording reception in blue

10

**Previously Recorded Reception**

Previously recorded receptions are displayed in green

11

**Play Time**

Play time displays the time of the currently playing reception. This time can be manually set by clicking on it and entering the date and time as shown below.

17:02:54










12

**UTC/Local**

Click on this item to toggle between Local time and UTC time

Local

13

**Enable/Disable Recording**

Enables/Disables writing to the database



14

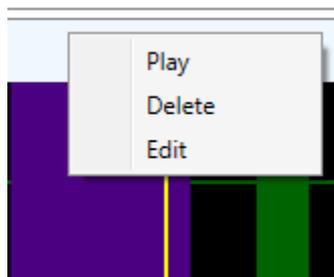
**Span**

Displays and sets the time span of the reception display

Time Span: 

The play time also be set by double clicking anywhere on the time line. The location of the double click will set the time.

Receptions can be played, edited, or deleted by right clicking on the reception and selecting Play, Edit, or Delete as shown below

**4.10.2. Reception Display**

On the right side of the screen is a display of the recent receptions. To playback a given resception simply double click on it.

Start Time	End Time	Frequency
19:23:04	19:23:19	154.19
19:21:34	19:21:49	154.19
19:21:09	19:21:22	154.19
19:18:37	19:19:29	154.19
19:17:39	19:17:52	154.19
19:17:06	19:17:21	154.19
19:16:24	19:16:41	154.19
19:14:11	19:14:46	154.19
19:13:51	19:13:52	154.19
19:13:21	19:13:36	154.19
19:12:41	19:12:54	154.19
19:12:09	19:12:22	154.19

To edit the reception or delete the receipt, right click on it and select the desired action.

### Receptions

Start Time	End Time	Frequency	
18:48:34	18:49:44	154.19	
18:47:00	18:48:22	154.19	
18:45:20			Edit
18:43:50			Delete

Selecting Edit will display the following dialog allowing the user to enter meta data describing the reception.

Edit Reception
✕

Start Date	Start Time	End Date	End Time	Frequency
03/26/2025	17:11:55	03/26/2025	17:12:42	154.19

Priority:  Subject:

Key Words

Comments

Start Time	Bearing	RSSI	Site
17:11:55.9	3.4	48	Doppler
17:11:56.4	2.8	48	Doppler
17:11:56.9	3.9	48	Doppler
17:11:57.4	3.6	44	Doppler
17:11:57.9	2.9	48	Doppler
17:11:58.4	4	48	Doppler
17:11:58.9	5.6	48	Doppler

### 4.10.3. Bearing List

On the left side of the screen the bearings for the reception are shown. Clicking on the bearing will move the playback timeline to that bearing

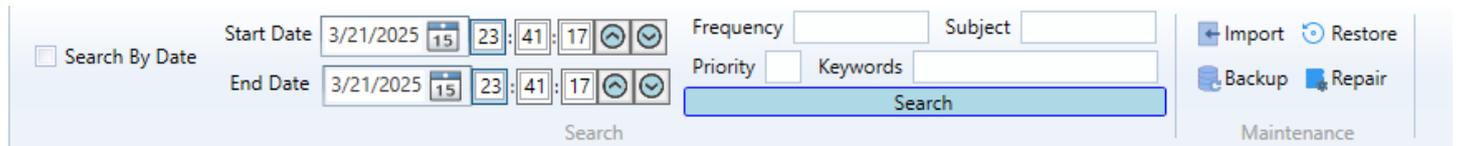
Click on bearing to begin playback at that time



Name	Time	Bearing	RSSI
1501	18:47:18.8	54	155
1501	18:47:19.3	52.6	155
1501	18:47:19.8	51.8	155
1501	18:47:20.3	53.2	155
1501	18:47:20.8	54.2	155
1501	18:47:21.3	54.2	155
1501	18:47:21.8	53	155
1501	18:47:24.0	53.7	155
1501	18:47:24.5	53.8	155
1501	18:47:25.0	55.4	155
1501	18:47:25.5	54.1	155
1501	18:47:26.0	52.5	155
1501	18:47:26.5	53.7	155
1501	18:47:27.0	55.2	155
1501	18:47:27.5	54.3	155
1501	18:47:28.0	52.9	155
1501	18:47:28.6	54.2	155

## 4.10.4. Database

Each reception is entered in a database. To playback or edit the meta data for the reception, click on the database tab on the ribbon menu.



Search By Date

Start Date: 3/21/2025 15:23:41:17

End Date: 3/21/2025 15:23:41:17

Frequency:  Subject:

Priority:  Keywords:

Maintenance

The database can be searched by date and time, by frequency or by the user parameters shown above. To initiate a search enter the desired parameters and press the Search button. If no parameters are entered, every reception in the database will be displayed. An example of parameterless search is shown below.

Search Results

### Reception Search Results

Start Date	Start Time	End Date	End Time	Frequency	Priority	Subject	System Name
05/04/2024	18:43:37	05/04/2024	18:43:54	154.19	0		DESKTOP-UOIMQ2B
05/04/2024	18:45:27	05/04/2024	18:45:48	154.19	0		DESKTOP-UOIMQ2B
05/04/2024	18:47:09	05/04/2024	18:48:33	154.19	0		DESKTOP-UOIMQ2B
05/04/2024	18:48:34	05/04/2024	18:49:44	154.19	0		DESKTOP-UOIMQ2B
06/26/2024	20:22:54	06/26/2024	20:23:49	162.55	0		DESKTOP-UOIMQ2B
06/27/2024	18:30:59	06/27/2024	18:31:31	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:31:41	06/27/2024	18:31:59	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:32:58	06/27/2024	18:33:46	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:33:55	06/27/2024	18:34:40	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:34:46	06/27/2024	18:36:19	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:36:54	06/27/2024	18:37:10	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:37:24	06/27/2024	18:37:25	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:39:49	06/27/2024	18:39:55	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:40:03	06/27/2024	18:40:34	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:40:41	06/27/2024	18:41:54	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:42:19	06/27/2024	18:42:34	154.19	0		DESKTOP-UOIMQ2B
06/27/2024	18:42:57	06/27/2024	18:43:12	154.19	0		DESKTOP-UOIMQ2B

Clicking on an entry in the results allows the user to play or edit the reception. To play the reception simply press Play Selected or double click on the reception and the it will be played back on the display.

## 5. Mobile Operation

---

TargetTrack 4 can be used for mobile direction finding as well as fixed site. A mobile direction finder requires a GPS receiver that outputs NMEA GPGGA and GPVTG messages once per second. Doppler recommends Garmin 16 or Garmin 18 GPS receivers. The GPS must be connected to the direction finding processor using a USB-to-Serial converter. Doppler recommends a FTDI based USB-to-Serial device.

### 5.1. Preparing the Computer

---

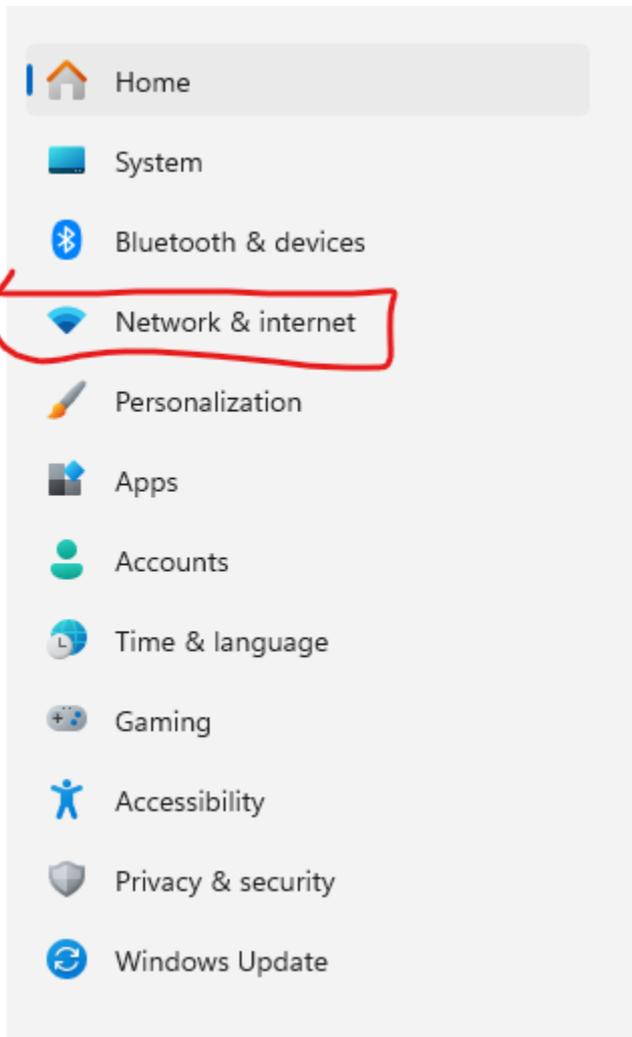
Typically when using TargetTrack 4 in a mobile application the a laptop computer is connected to the direction finder using a crossover cable which is supplied with the direction finder (some computers are auto sensing and do not require a crossover cable). Once connected the computer's Ethernet adapter must be configured to connect directly with the direction finder.

#### 5.1.1. Windows 11 Adapter Setting Instructions

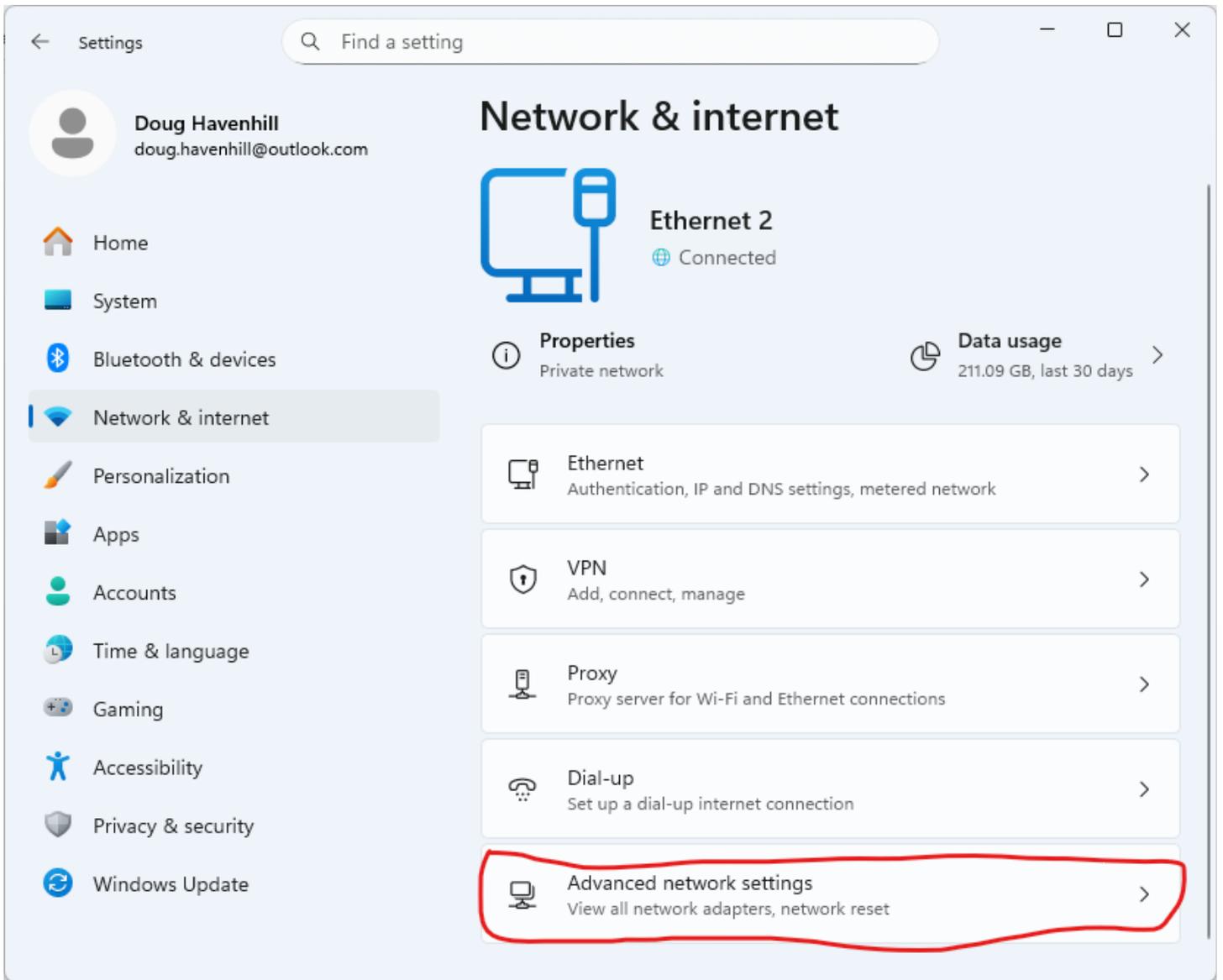
---

To configure the Ethernet adapter on Windows 11, first type Settings in the Windows Start menu.

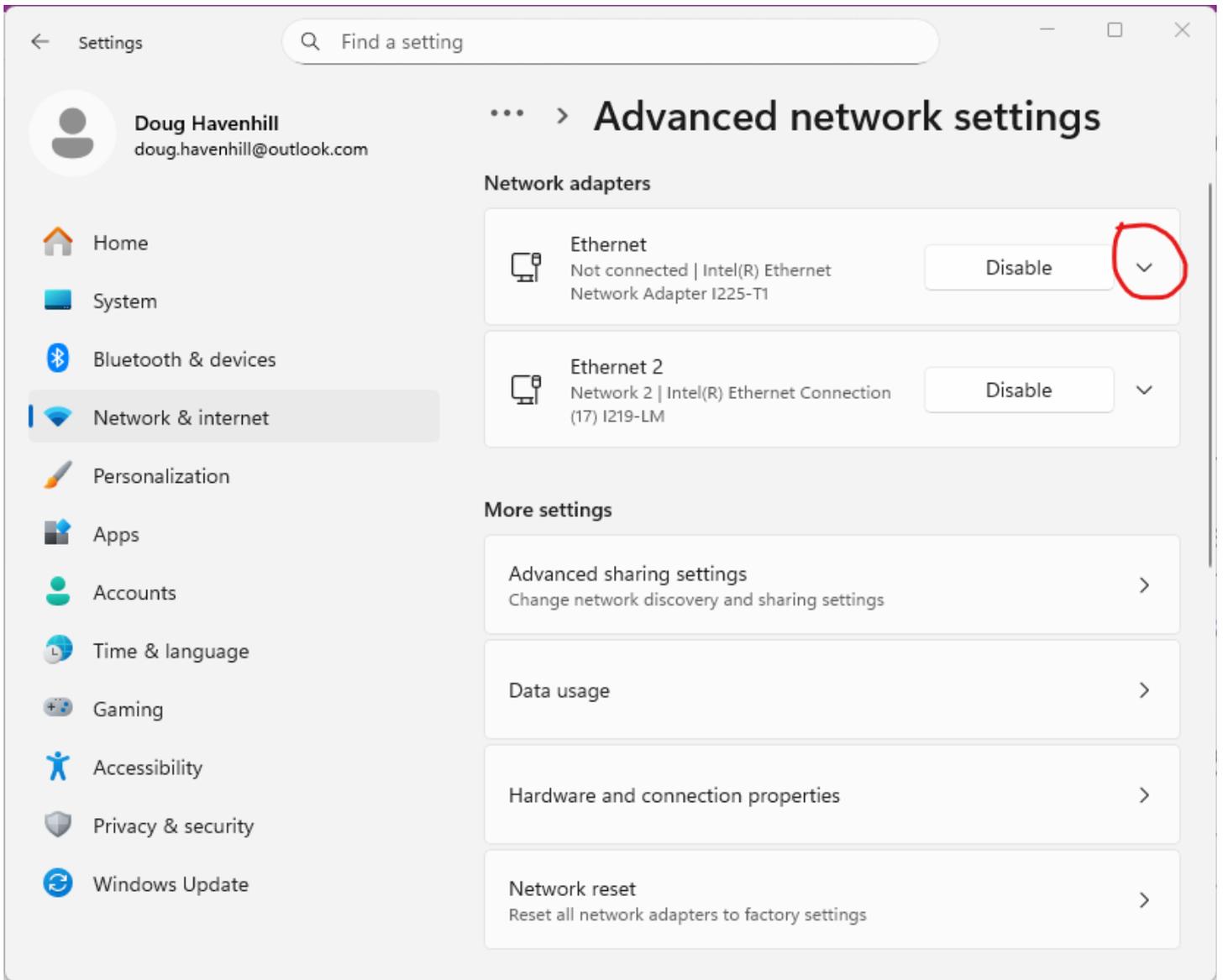
On the left side of the displayed screen select Network & internet



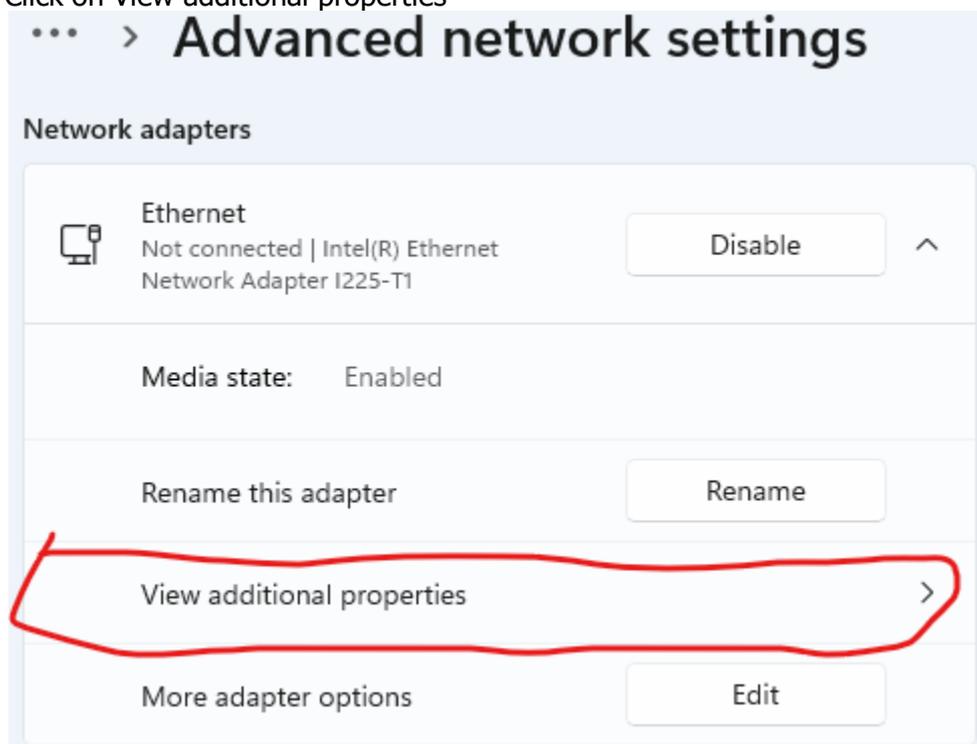
Click on Advanced network settings



Click on the down arrow next to the Ethernet adapter you are using to connect to the direction finder



Click on View additional properties



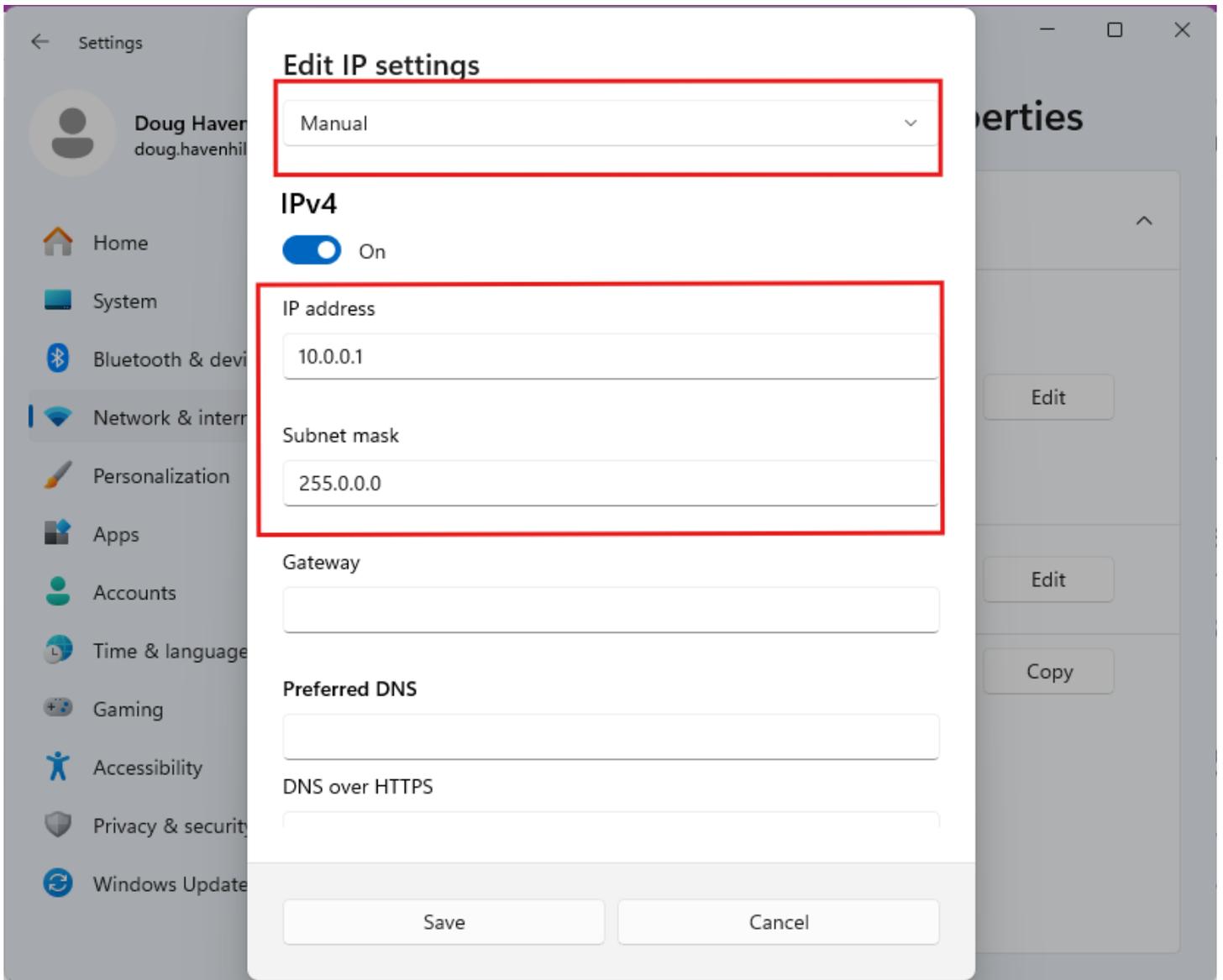
Click Edit

... > **View additional properties**

Ethernet 2 properties ^

IP assignment: Automatic (DHCP)	<b>Edit</b>
DNS server assignment: Automatic (DHCP)	Edit
Aggregated link speed (Receive/Transmit): 1000/1000 (Mbps)	Copy
Link-local IPv6 address: fe80::b780:7f08:d7a:3ed4%8	
IPv4 address: 192.168.1.63	

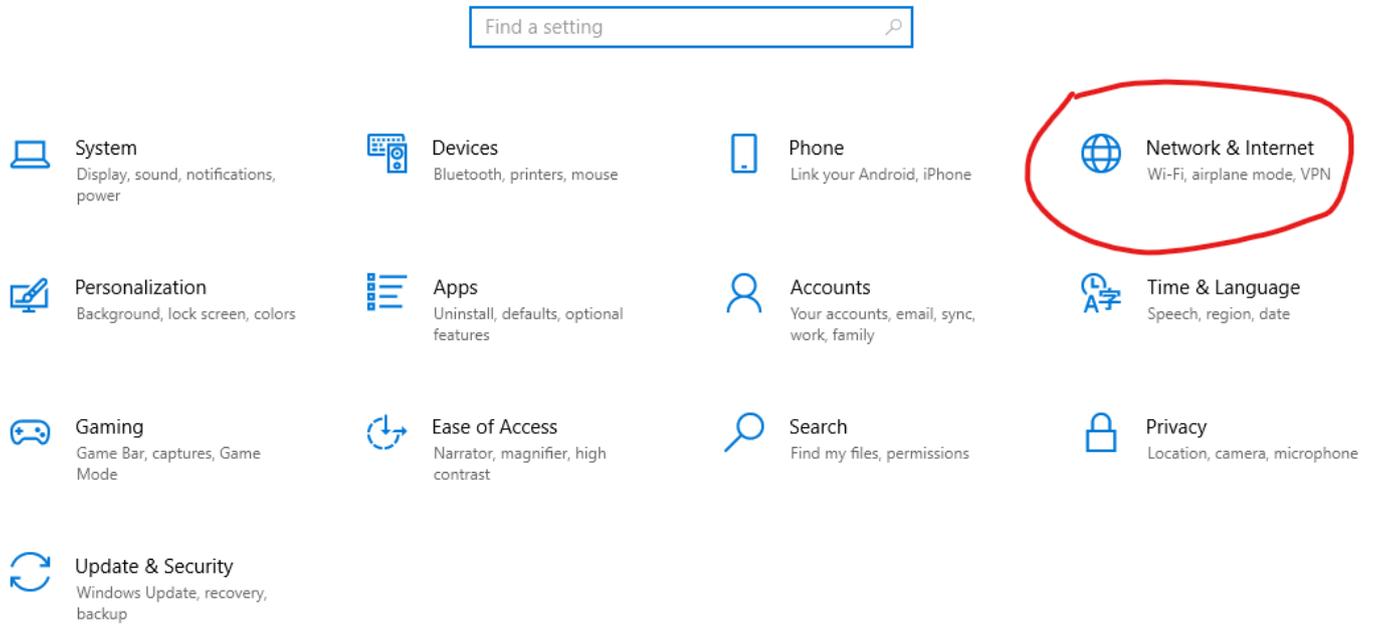
Change the settings to the settings shown below and press Save



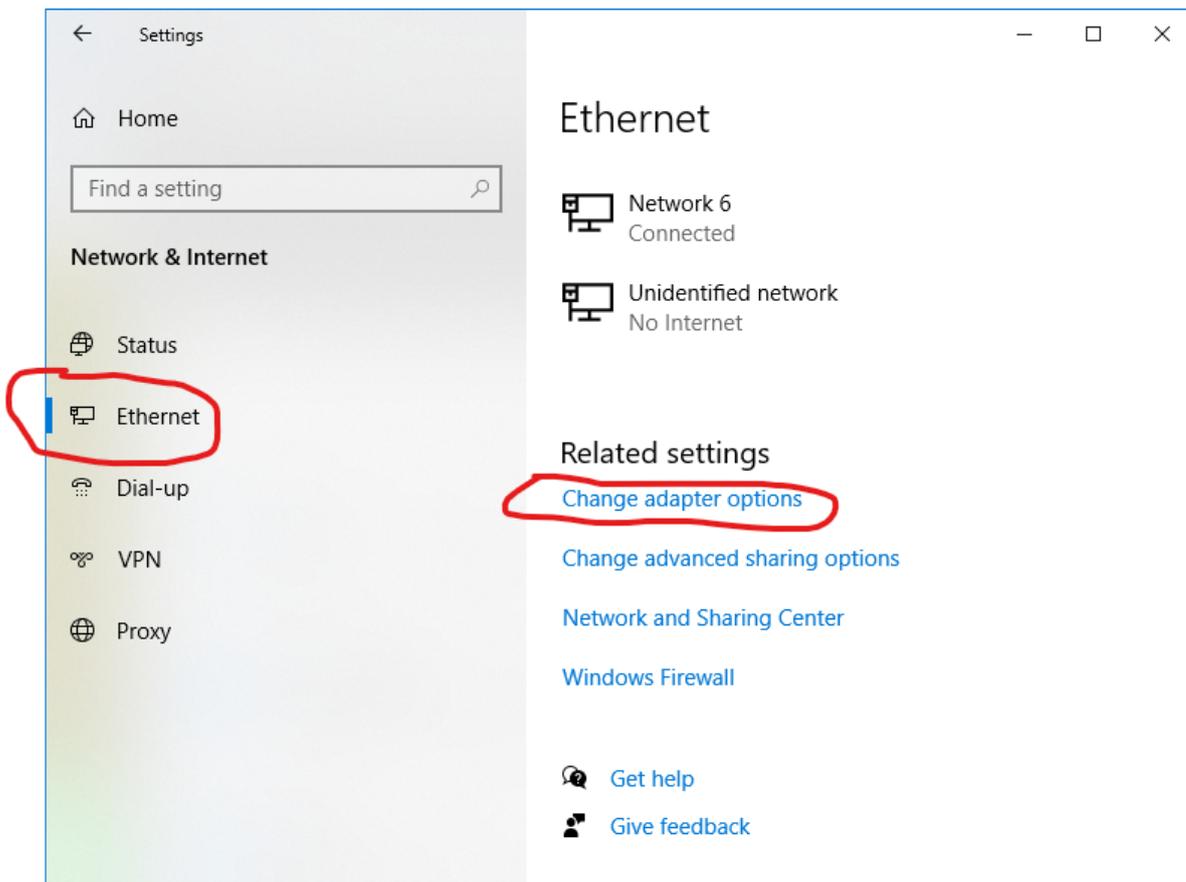
## 5.1.2. Windows 10 Adapter Setting Instructions

---

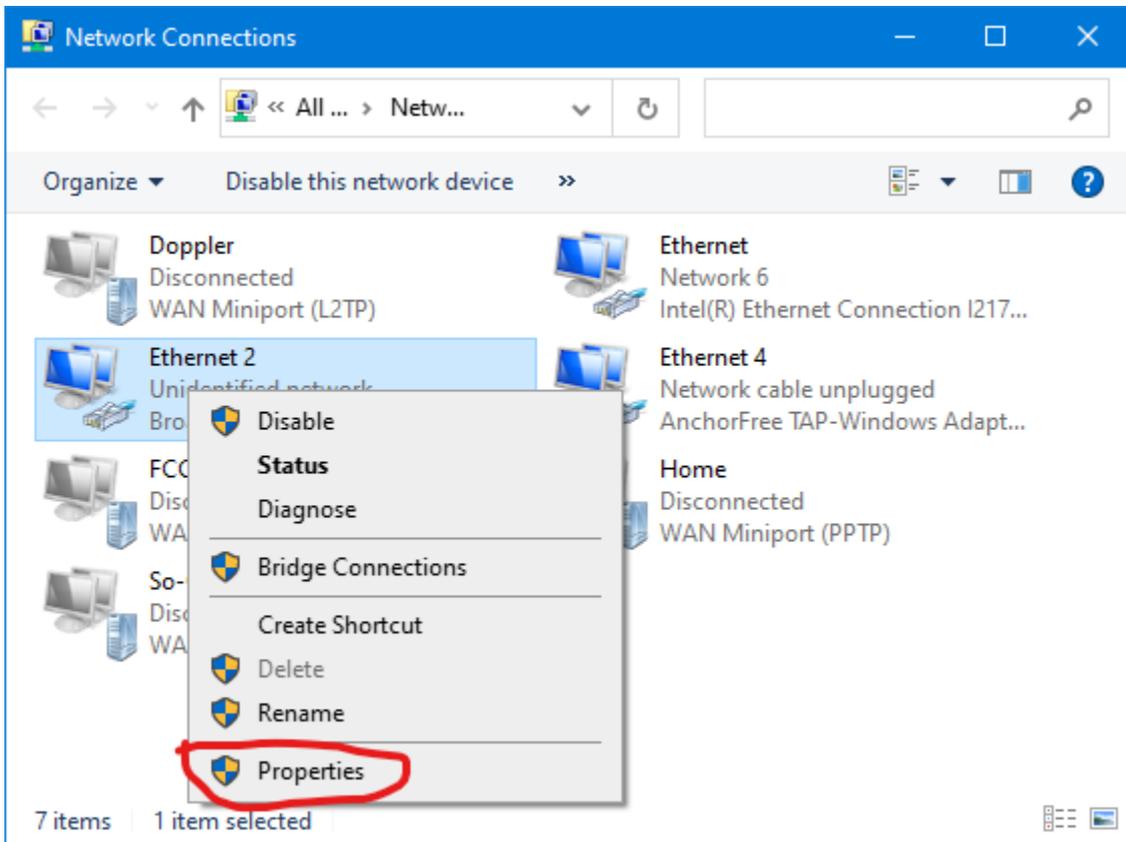
To change the adapter settings in Windows 10 select Settings from the Windows Start menu



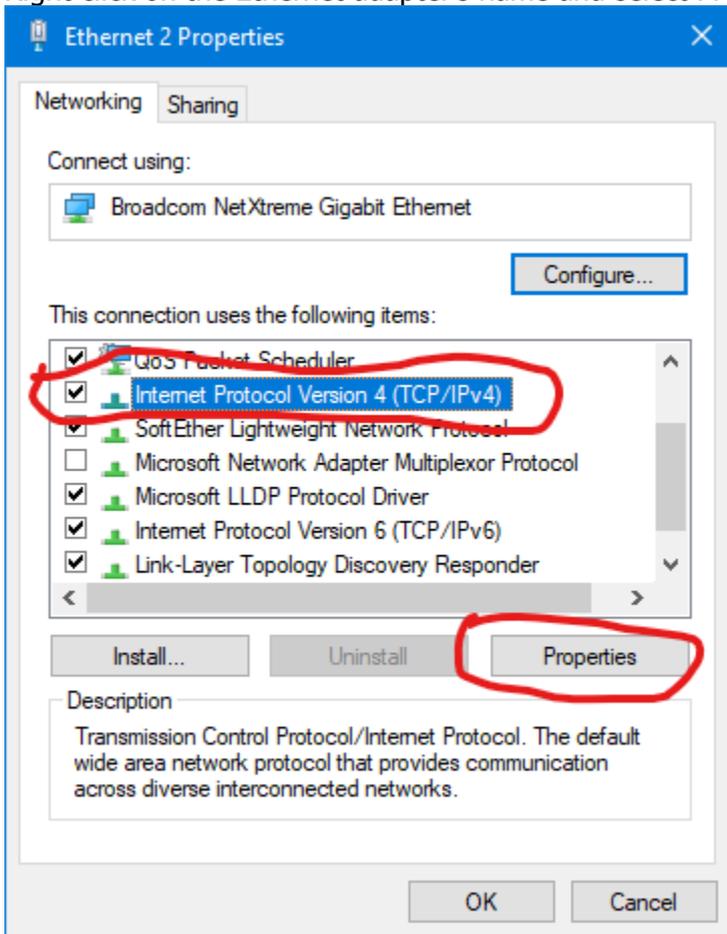
Click on Network & Internet and select Ethernet on the right side of the displayed window.



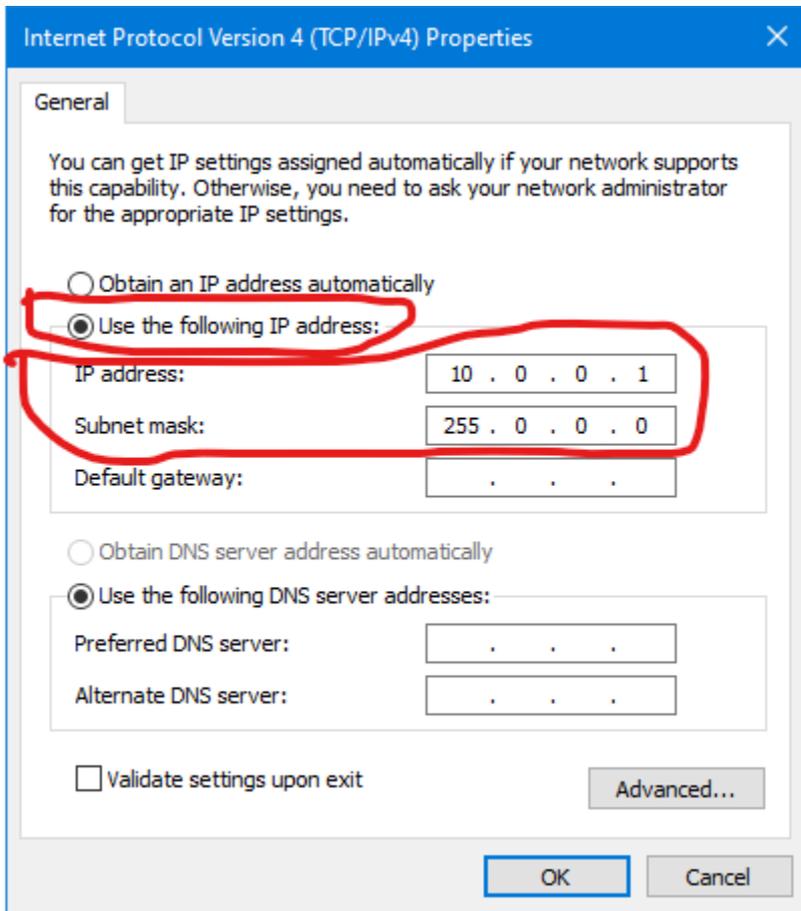
Press Change adapter settings



Right click on the Ethernet adapter's name and select Properties



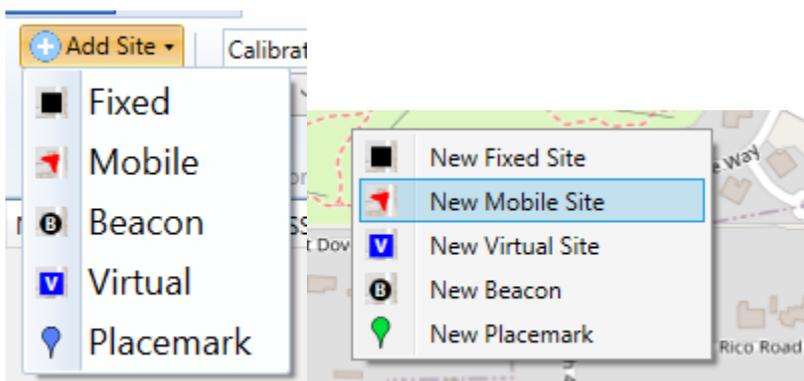
Select Internet Protocol Version 4 (TCP/IPv4) and then press the Properties button



Choose the Use the following IP address and enter an IP address of 10.0.0.1 and a subnet mask of 255.0.0.0 and press OK.

## 5.2. Adding a Mobile Site

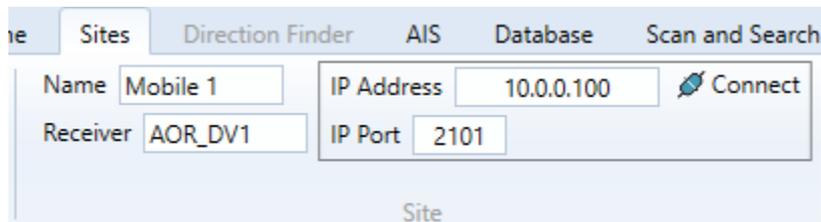
To initiate a mobile mission, select [New Mission](#) from the File menu. To add a mobile site go to the Site tab on the ribbon menu and select Mobile from the Add Site menu or right click on the map and select New Mobile Site from the pop up menu.



The site will appear on the map with an X through it.



On the Site tab enter the IP address of the direction finder and the IP Port. and press Connect



Name	Mobile 1	IP Address	10.0.0.100	Connect
Receiver	AOR_DV1	IP Port	2101	

Once connected the site will appear as shown below



## 5.3. Establishing a Heading

---

Accurate mobile direction finder bearings require an accurate heading from the GPS. To establish a heading move the direction finding vehicle in a straight line for about 20 meters. When a heading is established the arrow representing the mobile on the map will point in the direction of the heading.



Once a heading is established the application will display the LOB properly on the map.

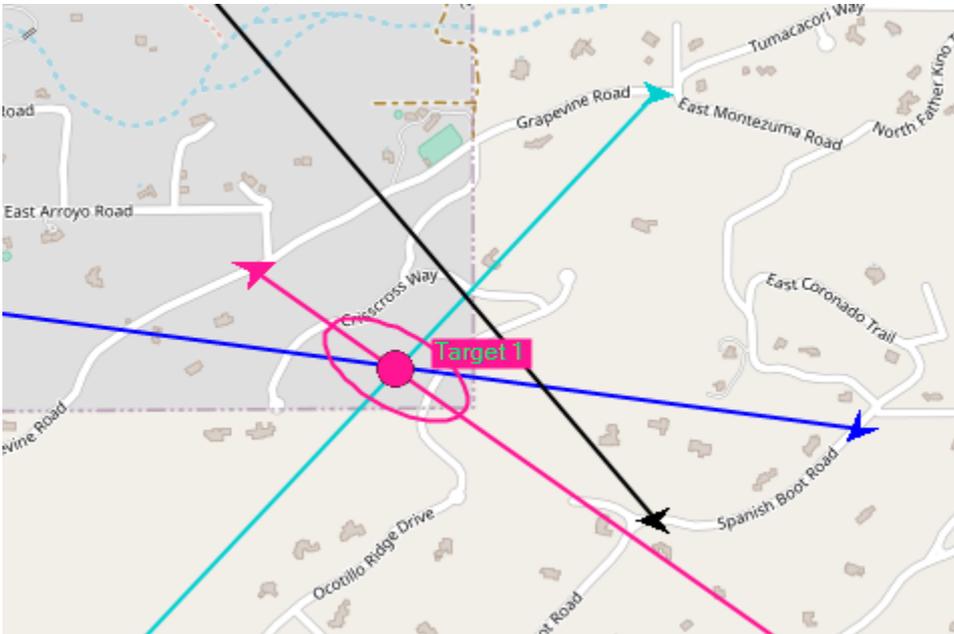
## 5.4. Mobile Targeting

---

Finding a transmission source using the mobile requires multiple bearing measurements from multiple locations. To achieve this you must save the mobile locations on the map. TargetTrack 4 uses the saved locations to calculate the location of the transmission sources.

To save a mobile location and bearing press the Insert Mobile button the on Home tab of the ribbon menu, press the Insert key on the keyboard, double click on the site on the map, or type Ctrl-I on the keyboard. This will lock the position of the mobile on the map.

Next drive to another location and wait for a transmission. When the next transmission is received insert that location. Once two locations are inserted TargetTrack 4 will calculate an estimated target location.



An inserted location can be deleted by clicking on it and pressing the delete key on the keyboard or by right clicking on the inserted site and selected Delete from the menu.

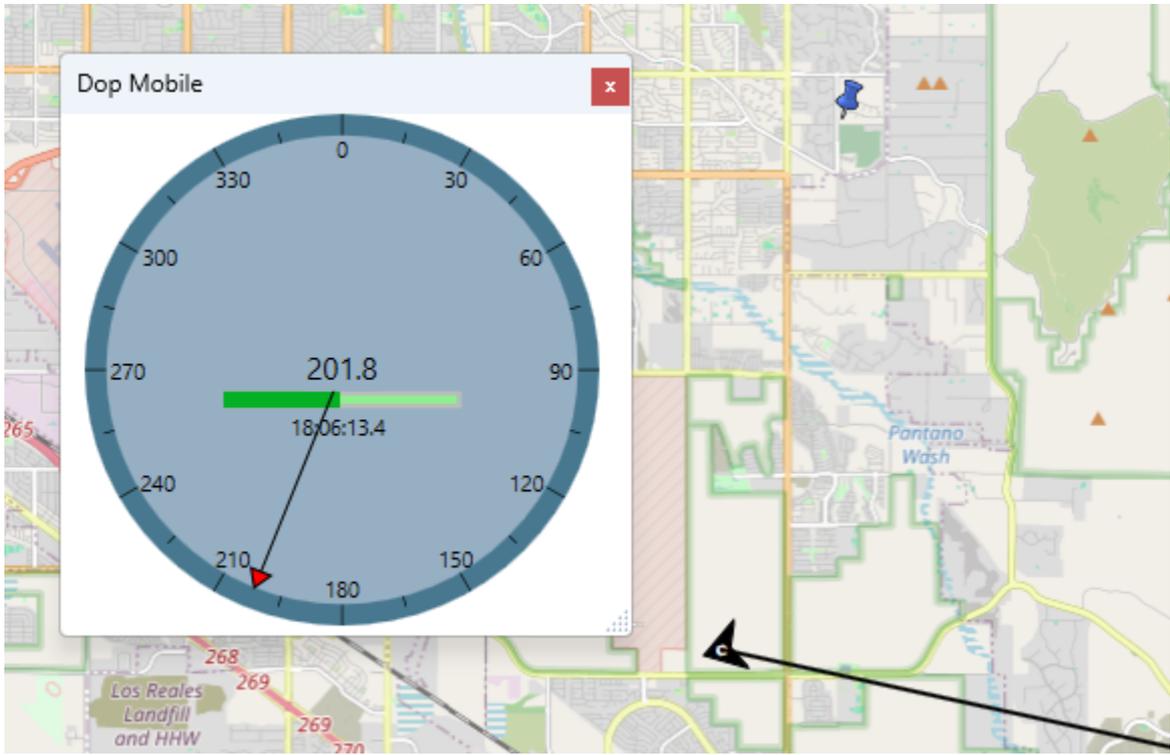
## 5.5. Compass Rose Display

---

In a typical mobile application the user wants to drive to the transmission source. When the vehicle is getting close to the target it is best to use a compass rose display. The compass rose display displays the bearing relative to the vehicle rather than to true north like it is shown on the map. This allows the user to direct the vehicle operator to drive in the direction indicated by the display. To activate the compass rose display press the Show Compass Rose button on the Home tab of the ribbon menu.



The figure below shows a sample of the compass rose overlaid on the map.



# 6. Mapping

The mapping engine in TargetTrack 4 is based on the open source software GMap.net. It allows the user to use a number of different Internet map data providers.

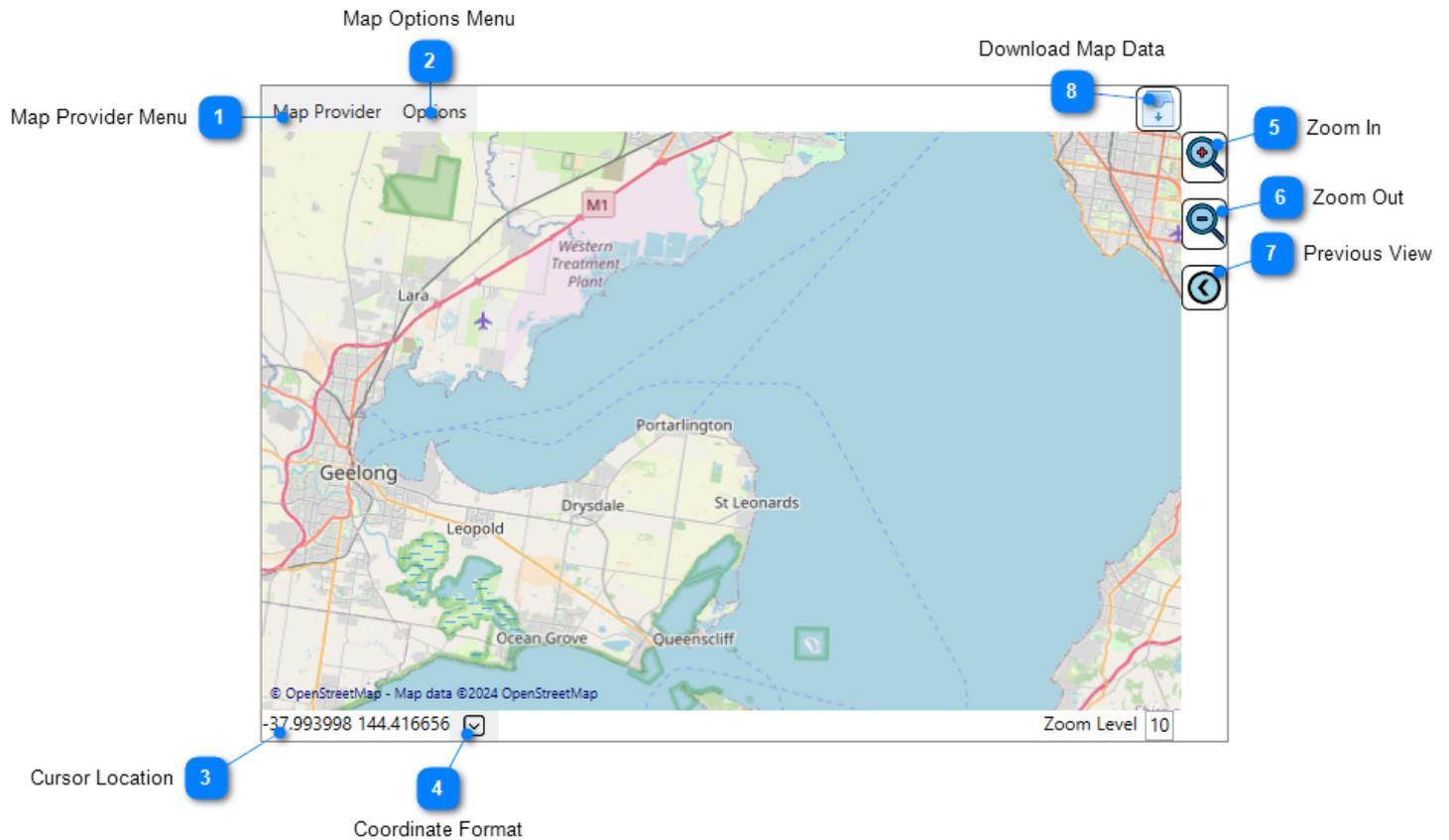
## Panning

To pan the map place the mouse over the map, press the left mouse button, and drag the map to desired location. You can also use the up, down, right, and left arrow keys to pan the map.

## Zooming

Zoom the map using the zoom controls on the right side of the map, or you can use the mouse wheel to zoom in or out.

Refer the the figure below for an explanation of the map operation.



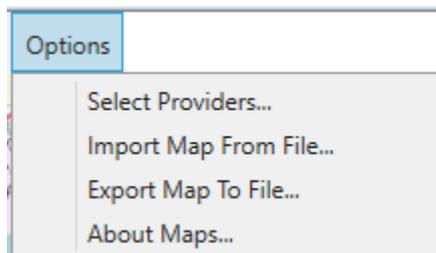
### 1 Map Provider Menu

The map provider menu allows the user to select what map provider to use. The default map map providers are shown below. Other providers can be added using the Options menu.

Map Provider	Options
<input checked="" type="checkbox"/>	OpenStreetMap
<input type="checkbox"/>	BingMap
<input type="checkbox"/>	BingSatelliteMap
<input type="checkbox"/>	GoogleMap
<input type="checkbox"/>	GoogleSatelliteMap

### 2 Map Options Menu

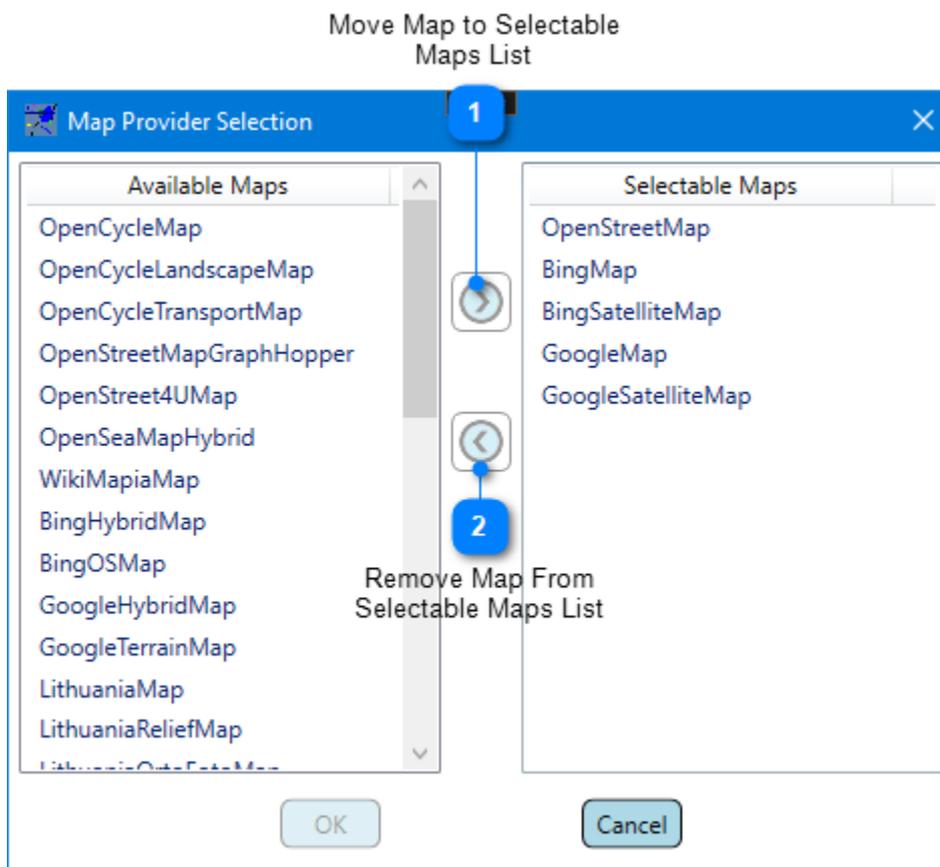
The Options menu is shown below.



## Select Providers

To add additional map providers or to remove map providers from the Map Providers menu, click on Select Providers.

The following dialog will be displayed.



### 1 Move Map to Selectable Maps List

To add maps to the Map Provider menu click on a map in the Available Maps list and press this button.



### 2 Remove Map From Selectable Maps List

To remove a map from the Map Providers menu click on the map in the Selectable Maps list and press this button



## Import and Export Maps

Map data can be exported to a file and imported as needed.

### 3 Cursor Location

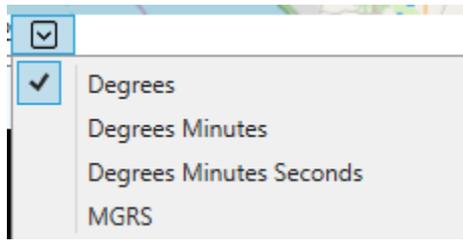
Displays the location of the cursor on the map.

`-37.993998 144.416656 |`

4

### Coordinate Format

Sets the coordinate system format for TargetTrack 4.



5

### Zoom In

Zooms in the map one level.



6

### Zoom Out

Zooms out the map one level.



7

### Previous View

Returns to the previous view of the map after zooming or panning.



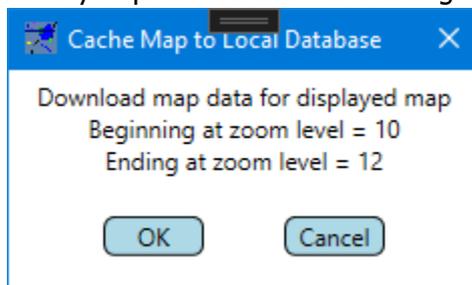
8

### Download Map Data

To use the map data off line it is necessary to cache the maps on the local computer. This can be accomplished by pressing this button



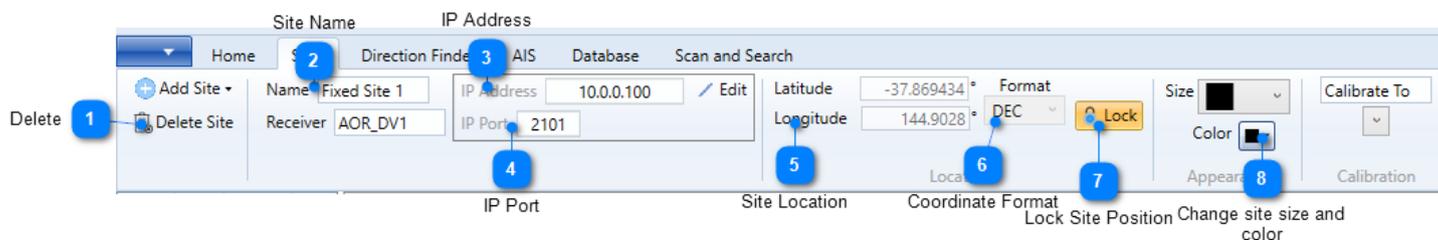
After you press the button a dialog similar to the one shown below will be shown



Press OK and the map data will be downloaded.

# 7. Editing Site Parameters

To edit the parameters of a site, left click on it. Then select the Sites tab on the ribbon menu as shown below



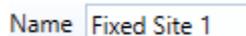
## 1 Delete

Press Delete Site to remove the selected site from the map. The site can also be deleted by selecting it and pressing the Delete key on the keyboard.



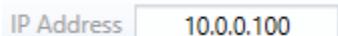
## 2 Site Name

Enter the name to use for the site. It is recommended to use a descriptive name such as the location of the site.



## 3 IP Address

Enter the IP address of the site



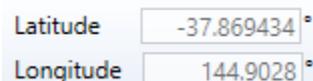
## 4 IP Port

Enter the IP port used by the site. The IP port number will always be 2101 unless it has been changed using the MPT User Interface Software



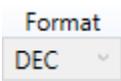
## 5 Site Location

Enter the latitude and longitude of the site. The location of the site can also be changed by dragging the site to a new location on the map.



## 6 Coordinate Format

The coordinate format can be set to Decimal, Degrees-Minutes, Degrees-Minutes-Seconds, or MGRS



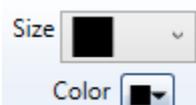
## 7 Lock Site Position

Press the lock button to prevent the user from accidentally moving the site. To release the lock press the button again.



## 8 Change site size and color

Change the size and/or color of the displayed site on the map



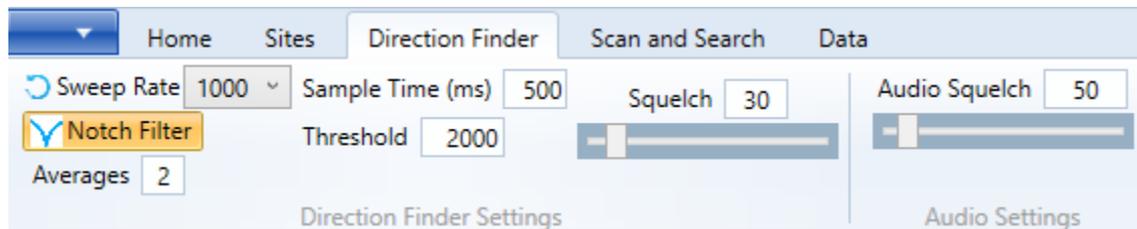
## 8. Direction Finder Settings

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In nearly all cases the default settings of the direction finder will be adequate. However, for special cases TargetTrack 4 provides a means of changing the settings. For an explanation of these settings see the MPT User Interface manual.

The one exception to the above statement is the squelch control. If a non primary site is displaying random bearings it is probable that the receiver squelch is open. The squelch can be adjusted using the squelch slider or by entering a value for the squelch (0 - 255) in the squelch value text box. Tune TargetTrack 4 to a frequency where you know there is no signal. Increase the squelch level until the bearings are no longer being displayed. If you wish to listen to the audio from the site while adjusting the squelch, you can temporarily make the site the primary site by pressing the Make Primary button on the Site tab of the ribbon menu.

Some direction finder settings can be changed from TargetTrack 4 by selecting Direction Finder tab on the ribbon menu as shown below

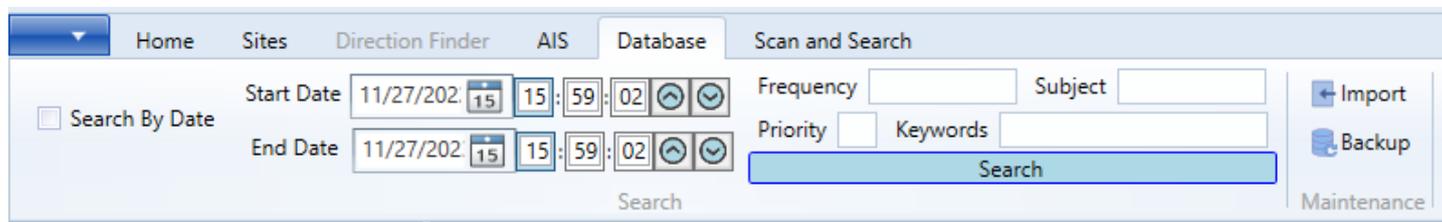


# 9. Database Operation

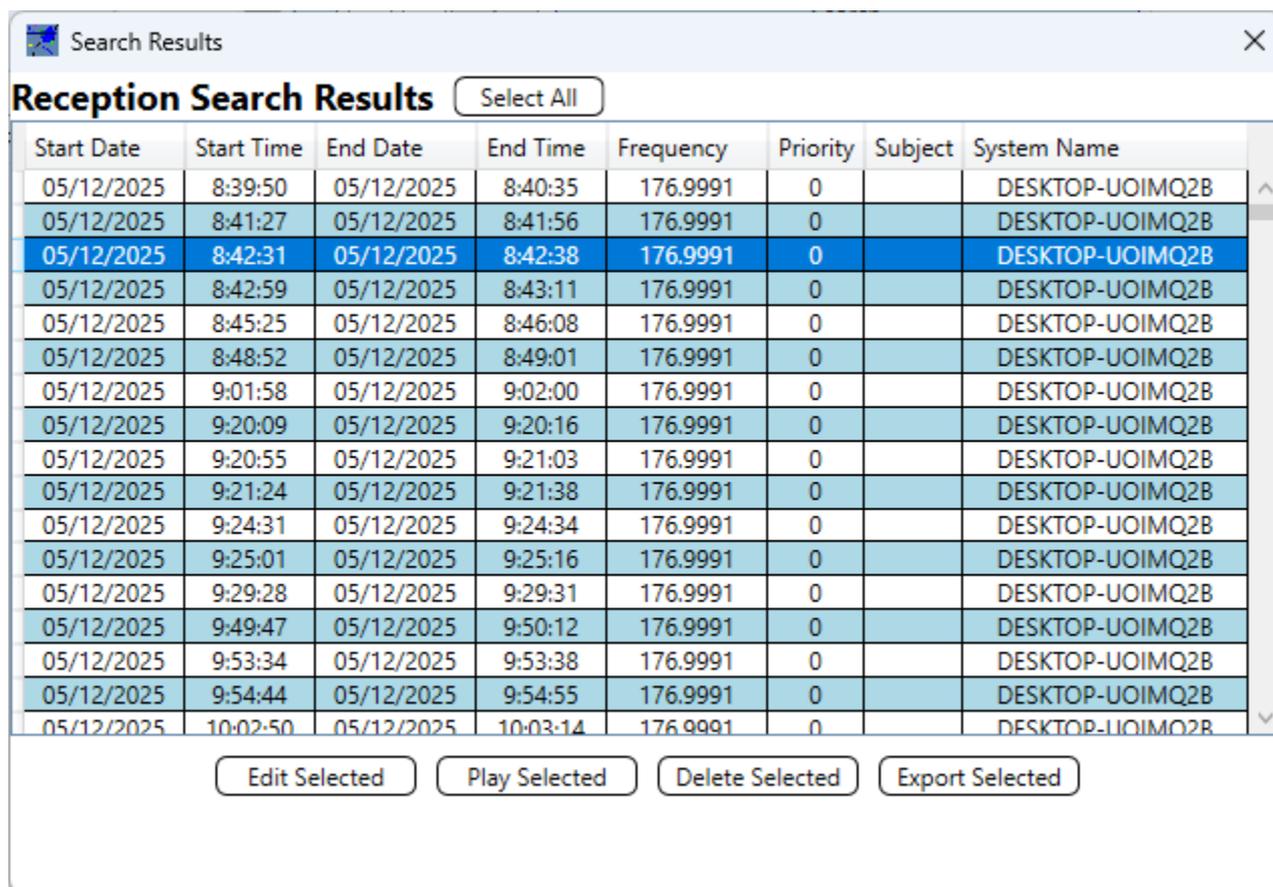
The TargetTrack 4 database records every reception.

## 9.1. Search

The database contains all the receptions recorded by TargetTrack 4. It is searchable using the parameters entered into the Database tab on the ribbon menu. Adding meta data (Frequency, Subject, Priority, and Keywords) can aid in the search by limiting the possibilities.



The figure below shows the Edit Reception dialog.



Start Date	Start Time	End Date	End Time	Frequency
03/26/2025	17:15:56	03/26/2025	17:16:14	154.19

Priority:  Subject:

Key Words:

Comments:

Start Time	Bearing	RSSI	Site
17:15:56.9	4.9	145	Doppler
17:15:57.4	3.9	48	Doppler
17:15:57.9	3.6	48	Doppler
17:15:58.4	2.3	44	Doppler
17:15:58.9	3	48	Doppler
17:15:59.4	5	44	Doppler
17:15:59.9	4.8	48	Doppler

Save Cancel

Meta data (Priority, Subject, Keywords, and Comments) can be entered for the reception. Keywords need to be separated by commas. Once the meta data is entered press Save. Now the database can be searched on the meta data entered.

You can also delete one or more receptions by selecting the receptions and pressing the Delete Selected button. You can also search on a field and then press Select All and delete or export all data associated with the search.

**Reception Search Results**

Start Date	Start Time	End Date	End Time	Frequency	Priority	Subject	System Name
05/12/2025	8:39:50	05/12/2025	8:40:35	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	8:41:27	05/12/2025	8:41:56	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	8:42:31	05/12/2025	8:42:38	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	8:42:59	05/12/2025	8:43:11	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	8:45:25	05/12/2025	8:46:08	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	8:48:52	05/12/2025	8:49:01	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:01:58	05/12/2025	9:02:00	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:20:09	05/12/2025	9:20:16	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:20:55	05/12/2025	9:21:03	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:21:24	05/12/2025	9:21:38	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:24:31	05/12/2025	9:24:34	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:25:01	05/12/2025	9:25:16	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:29:28	05/12/2025	9:29:31	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:49:47	05/12/2025	9:50:12	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:53:34	05/12/2025	9:53:38	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	9:54:44	05/12/2025	9:54:55	176.9991	0		DESKTOP-UOIMQ2B
05/12/2025	10:02:50	05/12/2025	10:03:14	176.9991	0		DESKTOP-UOIMQ2B

Edit Selected Play Selected Delete Selected Export Selected

If these are not receptions of interest then they can be deleted.

### TargetTrack Files

Files saved in .ttdf format can be imported into a TargetTrack 4 database so they can be deleted and restored at a later time if needed or they can be imported to a different computer running TargetTrack 4.

## 9.2. Exporting Data

You can export selected receptions so they can be imported into another TargetTrack database on a different computer or so they can be archived. The search results below show a search on the database over a date range from 3/1/2025 to 3/21/2025

Search By Date

Start Date: 11/11/2025 00:00:00

End Date: 11/21/2025 23:59:59

Search

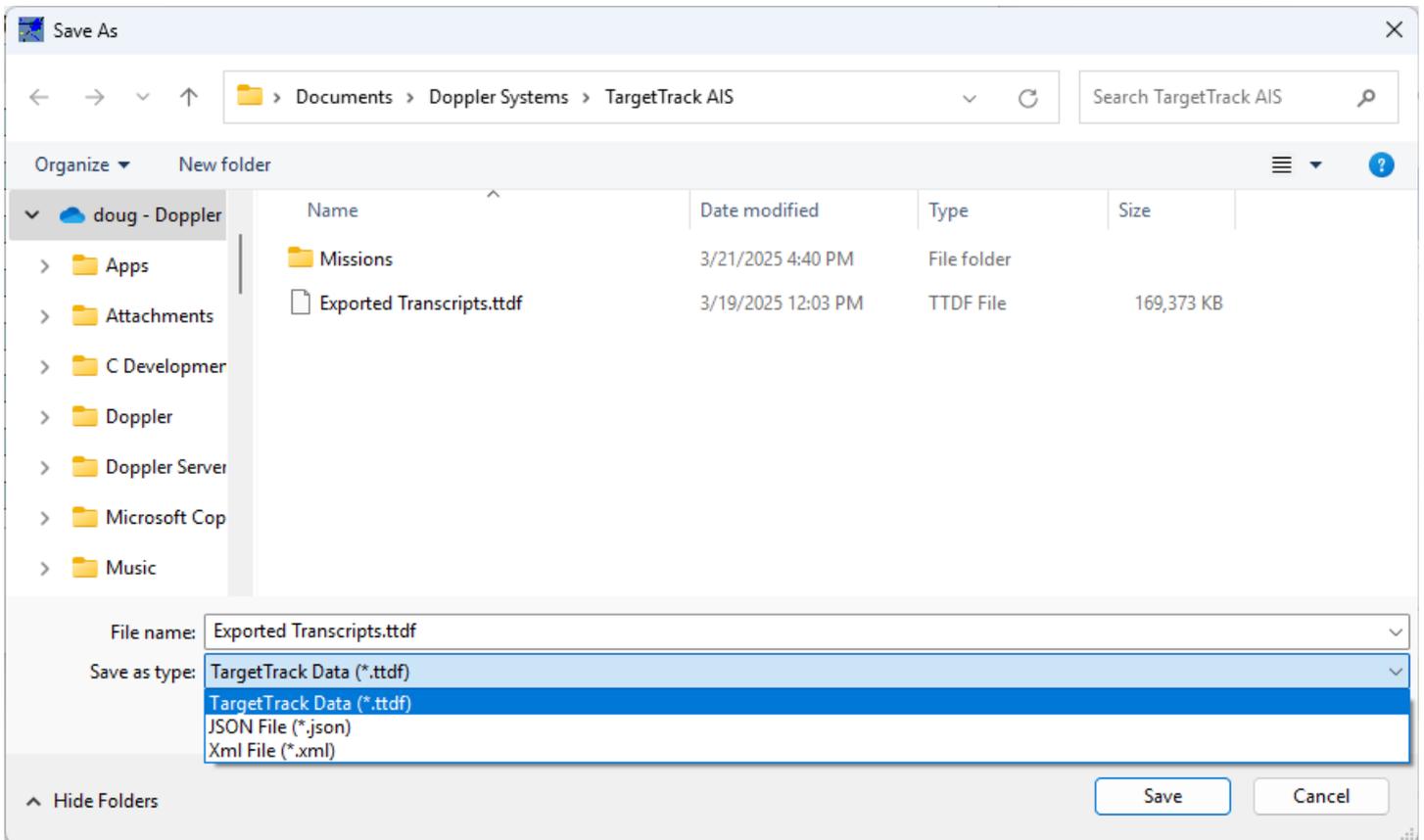
Search Results

### Reception Search Results

Start Date	Start Time	End Date	End Time	Frequency	Priority	Subject	System Name
03/21/2025	18:59:22	03/21/2025	18:59:35	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	19:05:52	03/21/2025	19:05:59	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	21:38:33	03/21/2025	21:38:37	145.33	0		DESKTOP-UOIMQ2B
03/21/2025	21:47:31	03/21/2025	21:47:48	162.55	0		DESKTOP-UOIMQ2B
03/21/2025	21:47:51	03/21/2025	21:47:54	162.55	0		DESKTOP-UOIMQ2B
03/21/2025	21:48:26	03/21/2025	21:48:37	162.55	0		DESKTOP-UOIMQ2B
03/21/2025	21:49:31	03/21/2025	21:49:35	162.55	0		DESKTOP-UOIMQ2B
03/21/2025	21:49:37	03/21/2025	21:49:42	162.53	0		DESKTOP-UOIMQ2B
03/21/2025	23:02:41	03/21/2025	23:02:46	162.55	0		DESKTOP-UOIMQ2B
03/21/2025	23:03:10	03/21/2025	23:03:35	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:03:46	03/21/2025	23:04:18	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:04:26	03/21/2025	23:04:40	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:04:49	03/21/2025	23:05:19	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:05:51	03/21/2025	23:06:04	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:06:31	03/21/2025	23:06:44	154.19	0		DESKTOP-UOIMQ2B
03/21/2025	23:30:48	03/21/2025	23:31:01	154.19	0		DESKTOP-UOIMQ2B

Edit Selected   Play Selected   Delete Selected   Export Selected

Selected all these results and pressing the Export Selected button will export the data to a user selected file. The data can be exported in one of three formats: ttdf (Doppler db format), JSON, and XML. After pressing the Export Selected button the following dialog will appear:



Select the desired format and press Save.

## 9.2.1. JSON Schema

### JSON Schema

If saved as a json document the JSON schema is as listed below. The AudioData is a mp3 file encrypted as a Base64 string.

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "array",
  "items": {
    "type": "object",
    "properties": {
      "Transcript": {
        "type": "object",
        "properties": {
          "ID": { "type": "integer" },
          "Comments": { "type": ["string", "null"] },
          "Subject": { "type": ["string", "null"] },
          "Keywords": { "type": ["string", "null"] },
          "StartTime": { "type": "integer" },
          "EndTime": { "type": "integer" },
          "SiteList": { "type": "string" }, // JSON-encoded string
          "Frequency": { "type": "number" },
          "SystemName": { "type": "string" },
          "Priority": { "type": "integer" },
          "Start": { "type": "string", "format": "date-time" },
          "End": { "type": "string", "format": "date-time" }
        }
      },
      "required": [
        "ID", "StartTime", "EndTime", "SiteList", "Frequency",

```

```

    "SystemName", "Priority", "Start", "End"
  ]
},
"Intercepts": {
  "type": "array",
  "items": {
    "type": "object",
    "properties": {
      "Intercept": {
        "type": "object",
        "properties": {
          "DirectionFinderSerialNumber": { "type": "string" },
          "DirectionFinderFirmwareVersion": { "type": "string" },
          "ID": { "type": "integer" },
          "BearingStartTime": { "type": "integer" },
          "BearingEndTime": { "type": "integer" },
          "AudioStartTime": { "type": "integer" },
          "AudioEndTime": { "type": "integer" },
          "Bearings": { "type": "string" }, // JSON-encoded string
          "Audio": { "type": ["string", "null"] },
          "Frequency": { "type": "number" },
          "TranscriptID": { "type": "integer" }
        },
        "required": [
          "DirectionFinderSerialNumber", "DirectionFinderFirmwareVersion",
          "ID", "BearingStartTime", "BearingEndTime", "AudioStartTime",
          "AudioEndTime", "Bearings", "Frequency", "TranscriptID"
        ]
      },
      "AudioData": { "type": "string" }
    },
    "required": ["Intercept", "AudioData"]
  }
},
"required": ["Transcript", "Intercepts"]
}
}
}

```

The JSON schema for the SiteList is

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "array",
  "items": {
    "type": "object",
    "properties": {
      "ID": { "type": "integer" },
      "Name": { "type": "string" },
      "IPAddress": { "type": "string" },
      "IPPort": { "type": "integer" },
      "AudioIPPort": { "type": "integer" },
      "SerialNumber": { "type": "integer" },
      "Type": { "type": "string" },
      "Latitude": { "type": "number" },
      "Longitude": { "type": "number" },
      "Frequency": { "type": "number" },
      "Color": { "type": "string" },
      "Receiver": { "type": "string" },
      "IsPrimary": { "type": "integer" },

```

```

    "Size": { "type": "integer" },
    "HardwareVersion": { "type": "string" },
    "SoftwareVersion": { "type": "string" }
  },
  "required": [
    "ID", "Name", "IPAddress", "IPPort", "AudioIPPort", "SerialNumber",
    "Type", "Latitude", "Longitude", "Frequency", "Color", "Receiver",
    "IsPrimary", "Size", "HardwareVersion", "SoftwareVersion"
  ]
}
}
}

```

The JSON schema for the Bearings is

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "IsAverage": { "type": "boolean" },
    "BearingColor": { "type": "string" },
    "DFName": { "type": "string" },
    "Frequency": { "type": "number" },
    "Id": { "type": "integer" },
    "Value": { "type": "number" },
    "RSSI": { "type": "integer" },
    "RandomStdDev": { "type": "number" },
    "StdDev": { "type": "number" },
    "Averages": { "type": "integer" },
    "AudioLevel": { "type": "integer" },
    "Latitude": { "type": "number" },
    "Longitude": { "type": "number" },
    "Time": { "type": "string", "format": "date-time" },
    "TimeUTC": { "type": "string", "format": "date-time" },
    "RotDirection": { "type": ["string", "integer"] },
    "Heading": { "type": "number" }
  },
  "required": [
    "IsAverage", "BearingColor", "DFName", "Frequency", "Id", "Value",
    "RSSI", "RandomStdDev", "StdDev", "Averages", "AudioLevel",
    "Latitude", "Longitude", "Time", "TimeUTC", "RotDirection", "Heading"
  ]
}

```

## 9.2.2. XML Schema

---

### XML Schema

If saved as an XML document the XML schema is as listed below. The AudioData is a mp3 file encrypted as a Base64 string.

```

<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="ArrayOfXMLTranscriptExport">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="XMLTranscriptExport" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Intercepts">

```

```

<xs:complexType>
  <xs:sequence>
    <xs:element name="XMLReceivedIntercept" maxOccurs="unbounded">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="Intercept">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="DirectionFinderSerialNumber" type="xs:string"/>
                <xs:element name="DirectionFinderFirmwareVersion" type="xs:string"/>
                <xs:element name="ID" type="xs:int"/>
                <xs:element name="BearingStartTime" type="xs:long"/>
                <xs:element name="BearingEndTime" type="xs:long"/>
                <xs:element name="AudioStartTime" type="xs:long"/>
                <xs:element name="AudioEndTime" type="xs:long"/>
                <xs:element name="Frequency" type="xs:double"/>
                <xs:element name="TranscriptID" type="xs:int"/>
                <xs:element name="BearingList">
                  <xs:complexType>
                    <xs:sequence>
                      <xs:element name="BearingModel" maxOccurs="unbounded">
                        <xs:complexType>
                          <xs:sequence>
                            <xs:element name="IsAverage" type="xs:boolean"/>
                            <xs:element name="BearingColor">
                              <xs:complexType>
                                <xs:sequence>
                                  <xs:element name="A" type="xs:int"/>
                                  <xs:element name="R" type="xs:int"/>
                                  <xs:element name="G" type="xs:int"/>
                                  <xs:element name="B" type="xs:int"/>
                                  <xs:element name="ScA" type="xs:float"/>
                                  <xs:element name="ScR" type="xs:float"/>
                                  <xs:element name="ScG" type="xs:float"/>
                                  <xs:element name="ScB" type="xs:float"/>
                                </xs:sequence>
                              </xs:complexType>
                            </xs:element>
                            <xs:element name="DFName" type="xs:string"/>
                            <xs:element name="Frequency" type="xs:double"/>
                            <xs:element name="Id" type="xs:int"/>
                            <xs:element name="Value" type="xs:double"/>
                            <xs:element name="RSSI" type="xs:int"/>
                            <xs:element name="RandomStdDev" type="xs:double"/>
                            <xs:element name="StdDev" type="xs:double"/>
                            <xs:element name="Averages" type="xs:int"/>
                            <xs:element name="AudioLevel" type="xs:int"/>
                            <xs:element name="Latitude" type="xs:double"/>
                            <xs:element name="Longitude" type="xs:double"/>
                            <xs:element name="Time" type="xs:dateTime"/>
                            <xs:element name="TimeUTC" type="xs:dateTime"/>
                            <xs:element name="RotDirection" type="xs:string"/>
                            <xs:element name="Heading" type="xs:int"/>
                            <xs:element name="Selected" type="xs:boolean"/>
                          </xs:sequence>
                        </xs:complexType>
                      </xs:element>
                    </xs:sequence>
                  </xs:complexType>
                </xs:element>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>

```



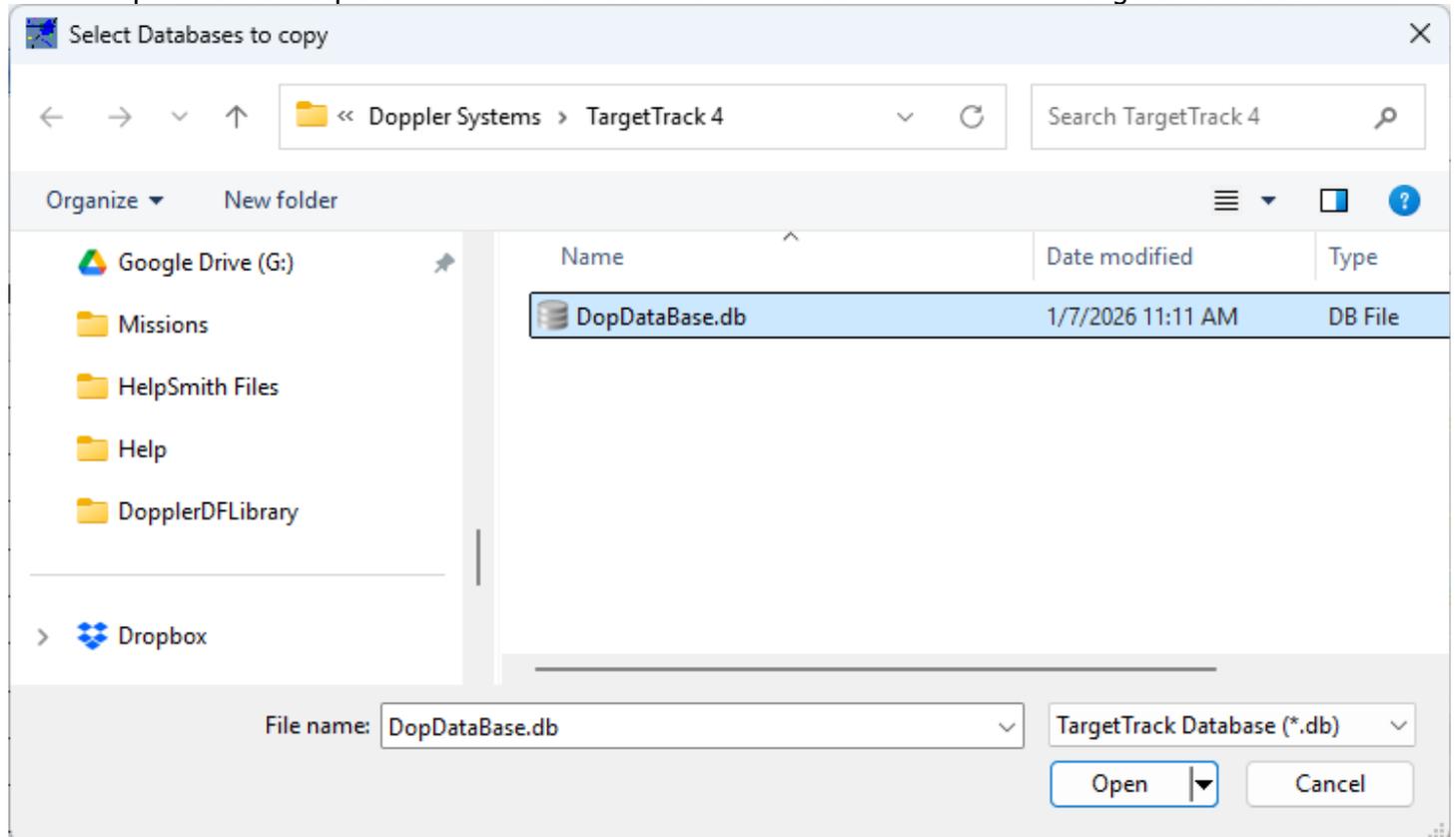
## 9.3. Maintenance

---

### 9.3.1. Backup

---

It is recommended to back up the database on a regular basis in case of database corruption. To back up the database press the Backup button on the Database tab in the ribbon menu. The dialog below will be shown



Select the database to be backed up and press Open to display the Saved Menu.

Select the folder (directory) in which to save the database and press Save.

### 9.3.2. Import

---

To import data press the Import button on the Database tab of the ribbon menu. Select the file to import and the data from the file will be imported into the database.

### 9.3.3. Restore

---

Select to restore the database entries from a previously exported .ttdf file.

## 9.3.4. Repair

---

Use this feature to repair a database that may be corrupted.

# 10. Scan and Search

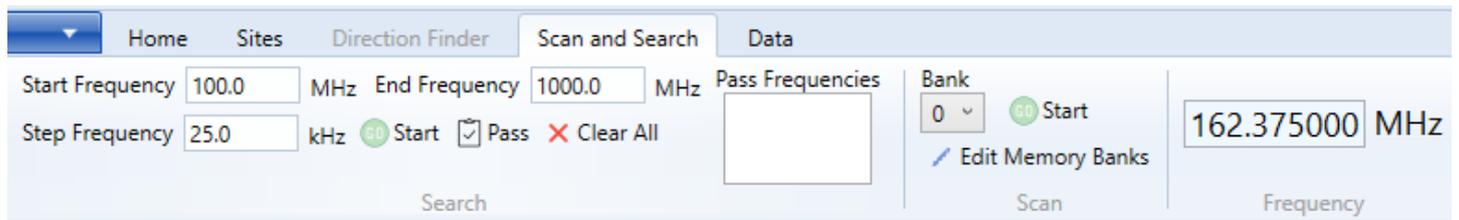
TargetTrack 4 can program the AOR DV1 or the ICOM R8600 receivers to search or scan frequencies. If either of these receivers are being used, the Scan and Search tab will be shown on the menu ribbon.

A search consists of a starting frequency, an ending frequency, and a frequency step. When the search is initiated the receiver begins at the starting frequency moves up in frequency by the step frequency until it receives a signal. Once a signal is received TargetTrack 4 will tune all the other receivers on the network to the received frequency and begin to take and display data. When the transmission ends the search resumes. Additionally, if the receiver stops on an undesired frequency, that frequency can be added as a pass frequency and the receiver will no longer stop searching when a signal is received on the pass frequency.

A scan consists of a list of frequencies entered by the user. The receiver will scan through these frequencies and stop when a signal is received. When a signal is received TargetTrack 4 will tune all other receivers to the frequency and begin data collection. When the transmission is complete the scan will resume.

The discussion below will explain the data entry required to initiated searches and scans.

The figure below shows the Search and Scan tab from the ribbon menu.

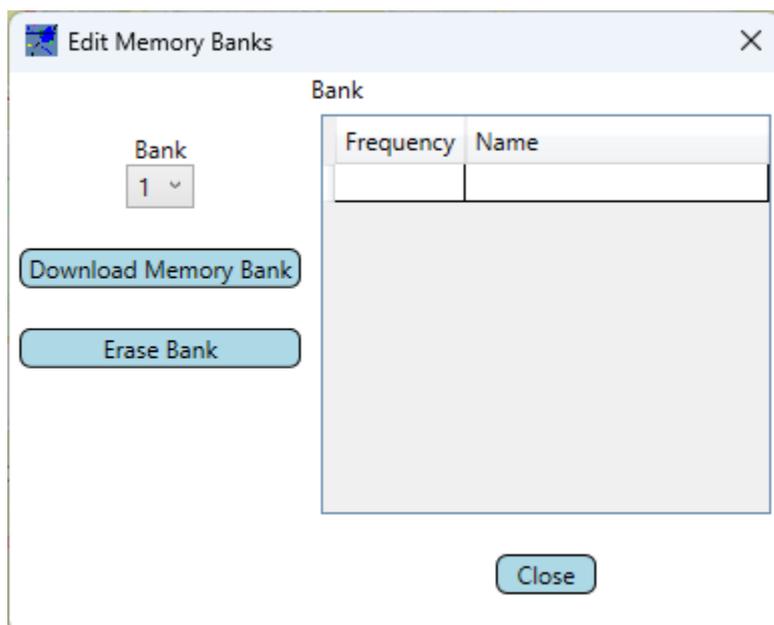


## Search

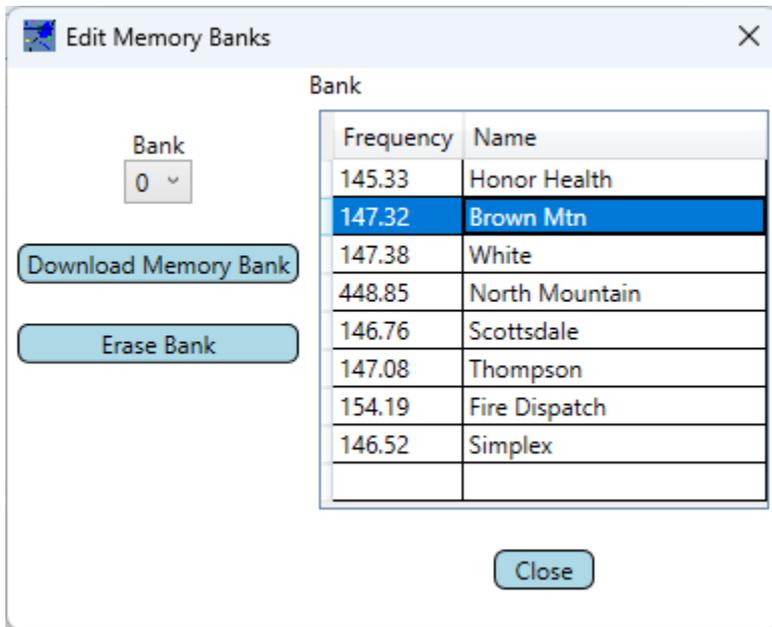
To initiate a search enter the start frequency, the end frequency, and the step frequency and press Start. If the receiver stops on a frequency that you do not want to collect data, press the Pass button and the frequency will be entered into the pass frequency list. The list can be edited by selecting a frequency from the list and pressing clear. The Clear All button will remove all the pass frequencies. When searching the Start button will turn into a Stop button. Press the Stop button to conclude the search.

## Scan

To scan a number of different frequencies, press the Edit Memory Banks button to display the following dialog



Click the Download Memory Bank button to download frequencies already stored in the receiver. The figure below shows an example of a download.



To add a frequency to the list, simply type it in at the end of the list and press the Tab key.

To delete a frequency, select it and press the Delete key.

To erase the entire bank, press the Erase Bank button.

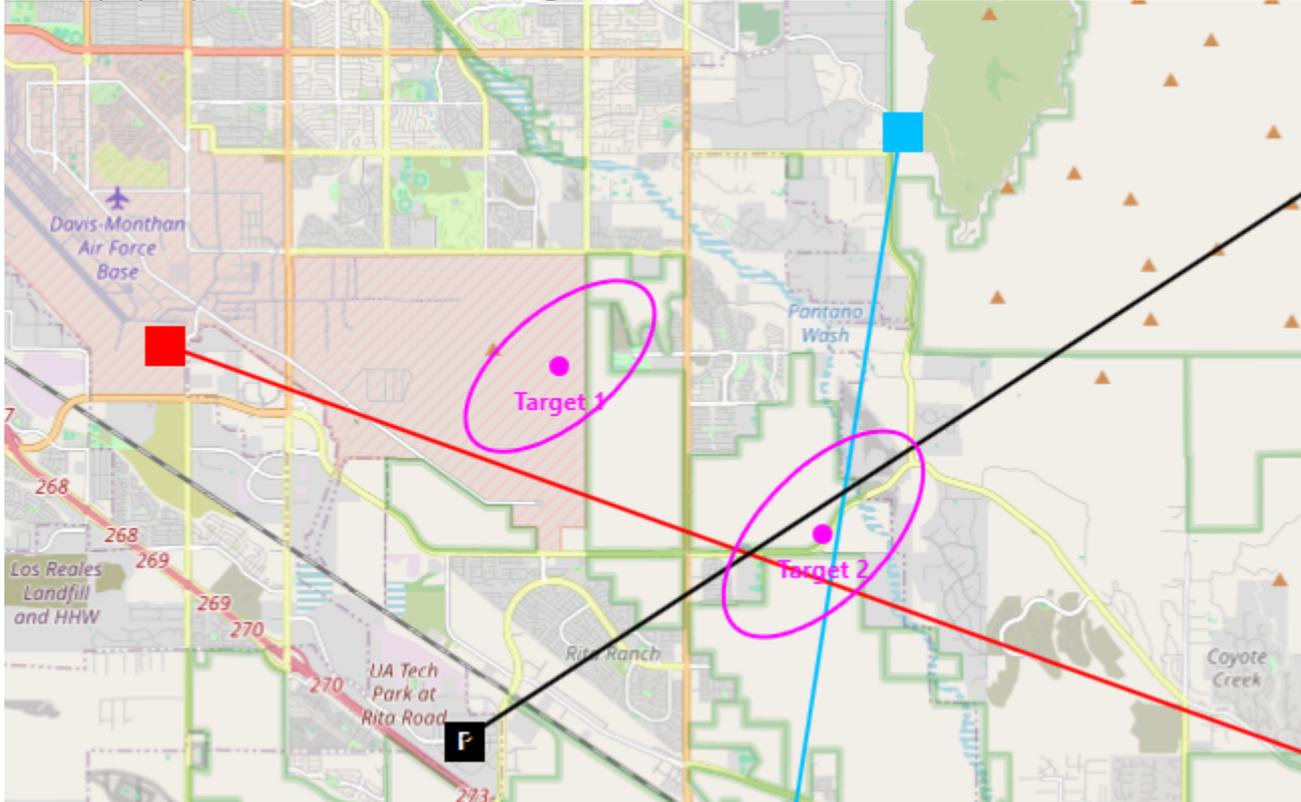
Up to 10 banks with 50 frequencies in each bank can be programmed.

To initiate a scan simply press the Start button. To terminate the scan press the button again.

# 11. Targeting

TargetTrack 4 can identify and track multiple targets. The positions of the targets are displayed on the map as a point surrounded by an ellipse. The point represents the estimated position of the target and the probability ellipse indicates there is a 95% probability that the target is somewhere within the ellipse. The Target display on the Home tab gives the location of the target and the CEP (circular error probable).

The display depicted below shows two targets



In this display Target 2 is the active target, Target 1 was an earlier estimated target.

On the Home tab of the menu ribbon the parameters of the active target are shown as demonstrated below

Name	Target 2	Latitude	N	32°	7.2112'	Delete
CEP	1695.0 m	Longitude	W	110°	45.0435'	
Active Target						

Clicking on Target 1 will display the parameters of this target as shown below.

Name	Target 1	Latitude	N	32°	8.7662'	Delete
CEP	1488.4 m	Longitude	W	110°	47.6327'	
Selected Target						

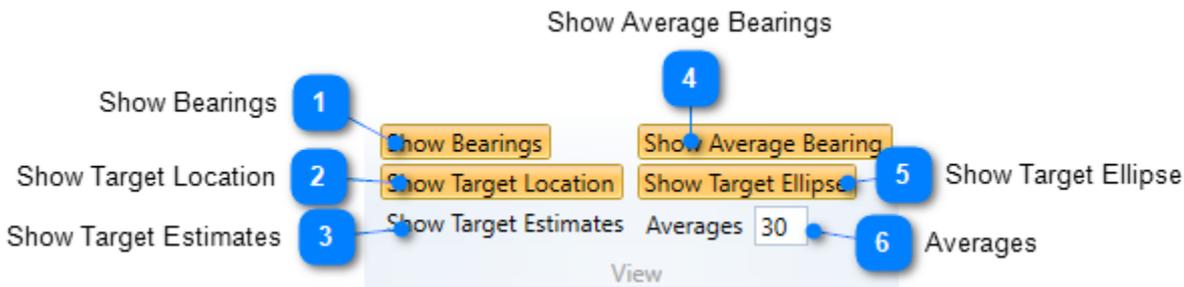
The targets can be deleted by pressing the Delete button next to the display or by selecting the target and pressing the Delete key.

All of the targets can be deleted by selecting one of the targets and pressing Shift + Delete.

When a signal is not present the targets will remain on the display.

# 12. View

The view pane on the Home tab of the ribbon menu can be used to customize the display of the targets and the bearings.



- 1 Show Bearings**

Select Show Bearings to display the bearing lines on the map. If this is unchecked no bearing lines will be shown.

Show Bearings
- 2 Show Target Location**

Select Show Target Location to show the estimated target location as calculated by TargetTrack 4. If this is unchecked the target location will not be displayed

Show Target Location
- 3 Show Target Estimates**

Each time a new bearing is received an instantaneous target estimate is calculated. If this item is checked each target estimate will be shown as a black dot. The dots will fade as the age of the Target increases.

Show Target Estimates
- 4 Show Average Bearings**

A running average of the bearings is used to calculate the average target location. If this is checked the average bearings will be displayed

Show Average Bearing
- 5 Show Target Ellipse**

Checking this button will display the uncertainty ellipse for the target.

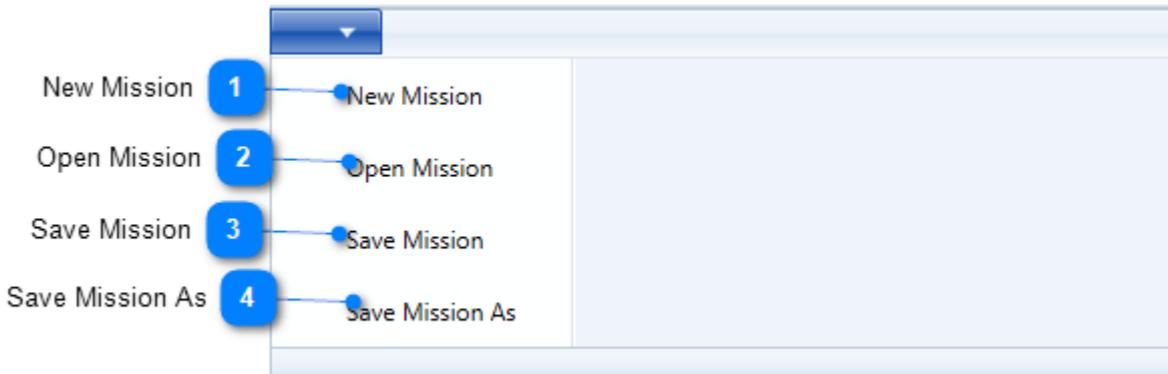
Show Target Ellipse
- 6 Averages**

The averages parameter sets the number of bearings that are averaged to calculate the estimated position of the target. Use a large value (~30) if the target is stationary or moving slowly. Decrease the averages for a fast moving target (~ 5 - 10).

Averages 30

# 13. File

When TargetTrack 4 is started, it will revert to the state it was in the last time it was ran. The file menu on the left side of the ribbon menu allows the user to save and open mission files. These files can be moved to a different computer if desired.



1

## New Mission

Select New Mission to begin a new blank mission. A new mission dialog will be displayed. (See below)

2

## Open Mission

Open Mission allows the user to open a saved mission.

3

## Save Mission

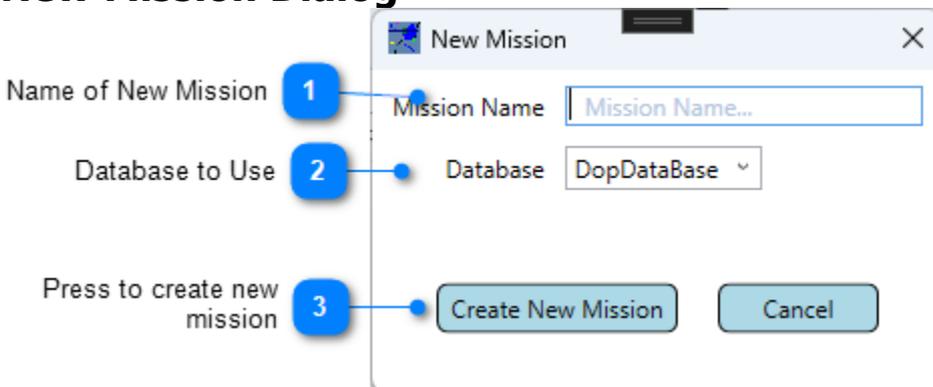
Select Save Mission to save the current TargetTrack state. Saving a mission will save all the sites, the beacons, and the map selections.

4

## Save Mission As

Performs same as Save Mission except it allows the user to select a file name

## New Mission Dialog



1

## Name of New Mission

Type in the name of the new mission

2

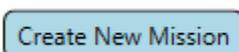
## Database to Use

Select the database you want to use to store the receptions. To add a new database, type in the name of the database you want to use. **Note: Typically this database does not need to be changed. If changed, when using this mission, only the receptions collected using this database can be played back or accessed via the Data tab.**

3

## Press to create new mission

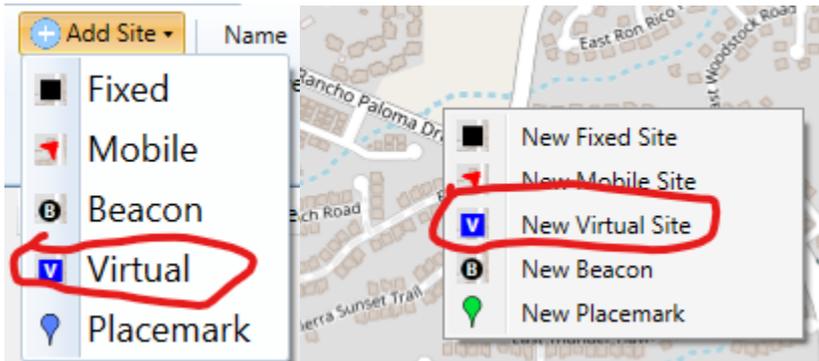
Pressing this button creates a new mission. All sites will be deleted; however, you will be prompted to determine if you want to save your current beacons and placemarks.





# 14. Virtual Sites

Virtual sites can be used to manually enter bearings. To add a virtual site select Virtual from the Add Site menu on the Site tab or right click on the map display and select New Virtual Site



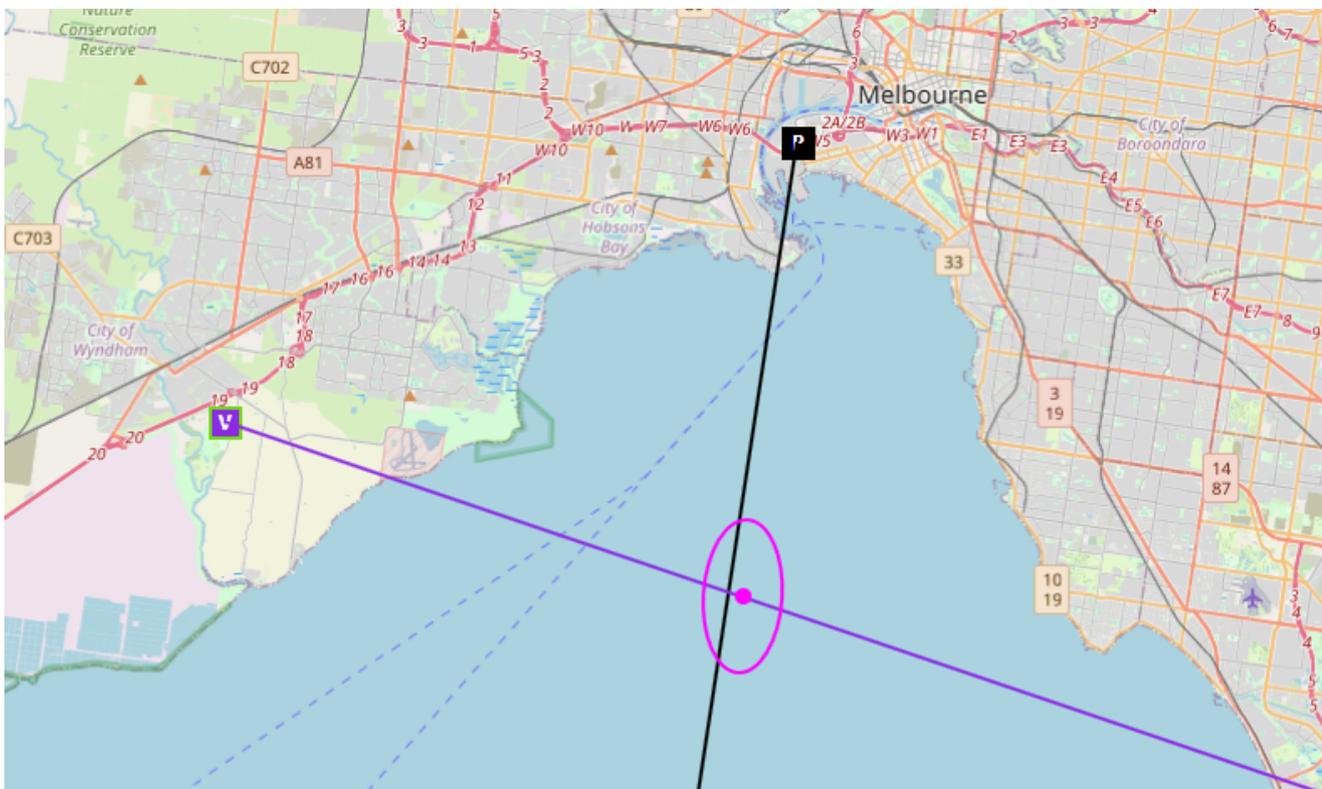
The site will be displayed on the map as shown below



Select the virtual site and on the Sites tab enter the name, frequency, and the bearing of the virtual site.

A screenshot of a form for configuring a site. It has three input fields: 'Name' with the value 'Virtual 1', 'Bearing' with the value '105', and 'Frequency' with the value '162.55'. Below the fields is a 'Site' label.

When the primary site receives a signal the a bearing line will be drawn from the virtual site, as shown below.

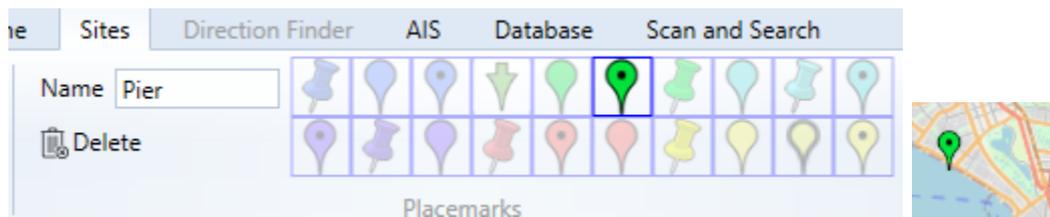




# 15. Placemarks

---

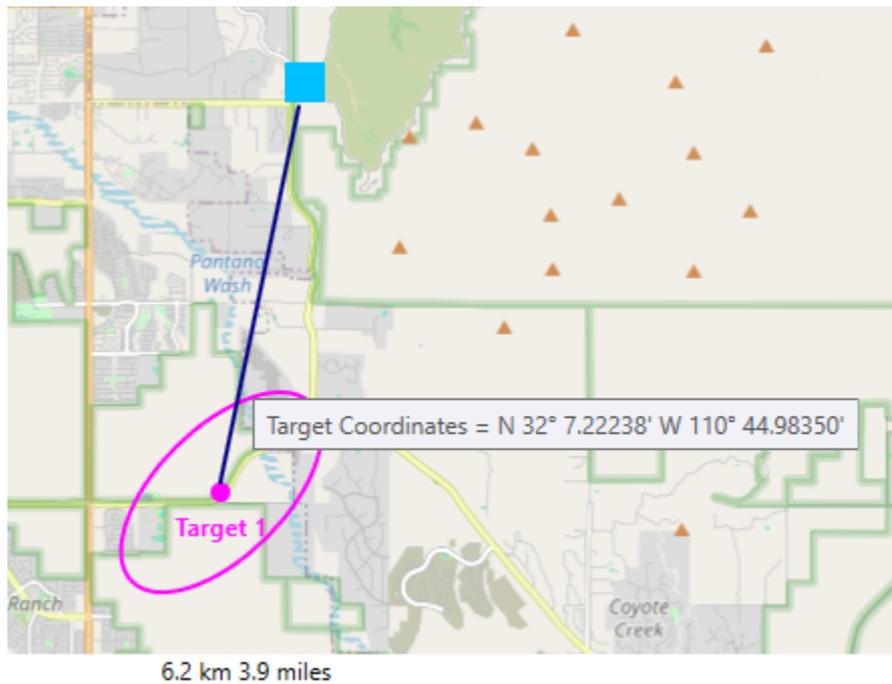
Placemarks may be added to the map to denote places of interest. To add a placemark select Placemark from the Add Site menu on the Sites tab of the ribbon menu or right click on the map and select New Placemark. Using the mouse drag the placemark to the desired position. On the Sites tab enter the name of the placemark and select the icon to be used for the placemark.



## 16. Measuring Distances on the Map

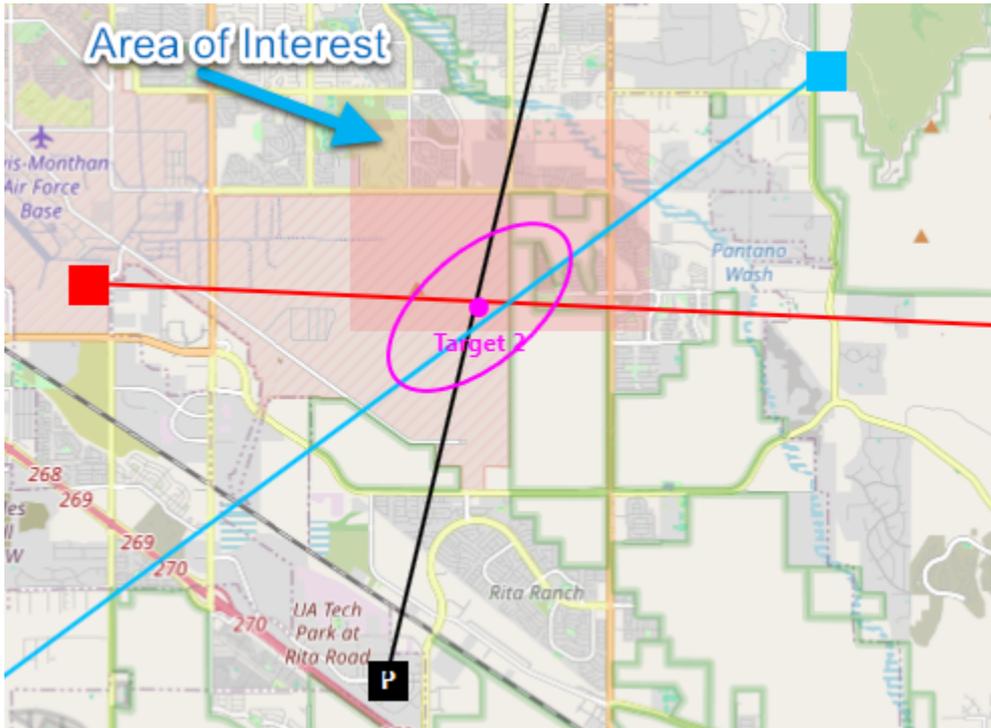
---

You can measure the distance from one point to another on the map. To measure a distance, press the Alt key on your keyboard and then use the mouse to draw a line from the starting point to the ending point. The length of the line will be displayed below the map in the center. The line will persist as long as the mouse button is pressed.



# 17. Limiting Target Area

If you know that the transmission source you are trying to locate is in a general geographic area, you can limit the area in which TargetTrack 4 will collect and display the bearing data and targets. This can be very helpful when monitoring busy frequencies. Targets not falling into the area will not be recorded. To enable this feature, hold down the shift and alt keys and use the mouse to draw the area of interest on the map.



If there is only one site, then the bearings measured by the direction finder will only be displayed and recorded if the bearing lines intersect the area on the map. If multiple direction finders are being used, then TargetTrack 4 will only display and record data if the estimated target location is inside of the area.

The area can be resized or dragged to a different location.

To remove the area place the mouse over the area and press the **Delete** key.

# 18. Bug Reporting

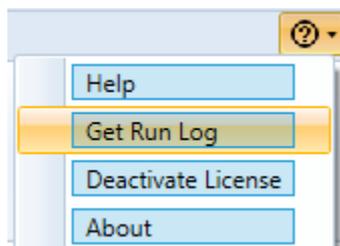
---

If you are experiencing a problem with the software or would like to see a feature added please send an e-mail to [brendah@dopsys.com](mailto:brendah@dopsys.com).

When reporting bugs be as thorough as possible in describing

- What happened
- What you were doing or trying to do when the bug occurred
- What state the program was in (e.g recording a reception, no bearing received, accessing the database, playing a previously recorded reception etc.)
- Screen shot if possible of the error
- Please attach the log file.

To get a log file go to the far right top of the ribbon menu and press the ? button



Select Get Run Log and save the file. Attach this file to the e-mail.

# 19. Support

---

Support for TargetTrack 4 is provided by telephone during regular business hours 7:00 am to 4:00 pm mountain standard time M-F or by email.

Contact: Doppler Systems Support

Telephone: 480-488-9755

e-mail: [brendah@dopsys.com](mailto:brendah@dopsys.com)