System Release 7.17.2
ASTRO® 25
INTEGRATED VOICE AND DATA

Interference Locator
Feature Guide

NOVEMBER 2017

MN004354A01-A

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Document History

Version	Description	Date
MN004354A01-A	Original release of the *Interference Locator Feature Guide*	November 2017

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About Interference Locator Feature Guide

This manual contains information on the Interference Locator.

What Is Covered in this Manual

This manual contains information regarding the operation of the Interference Locator application which can be used to identify the approximate location of RF interference sources. It includes instructions on how to calibrate the system to produce more accurate results, as well as how to process existing events within the system once calibration is complete. Events can also be processed with an uncalibrated system if necessary. Lastly, it describes how to export processed interference events to a KML file which can be viewed on a PC or tablet with an application such as Google Earth.

- Interference Locator Overview on page 19 provides basic information about the Interference Locator.
- Interference Locator Installation and Configuration on page 35 contains information on how to implement the Interference Locator feature in the system.
- Interference Locator Operation on page 37 describes how to use the Interference Locator feature to calibrate the interference analysis components and analyze the interference signal location data.
- Interference Locator Troubleshooting on page 43 provides any applicable scenarios for Troubleshooting the Interference Locator application.
- Interference Locator Disaster Recovery on page 45 provides the Disaster Recovery instructions for the Interference Locator application.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to *http://www.motorolasolutions.com/training* to view the current course offerings and technology paths.

Related Information

For associated information, see the following documents:

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as R56 manual. This document may be purchased by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Documentation Overview Feature Guide	Provides an overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.
Unified Network Configurator User Guide	Provides information relating to the implementation and management of centralized backup and restore services for sup-

Table continued…

Related Information	Purpose
	ported devices in ASTRO® 25 systems. This manual addresses server and client functions required for these services.
License Manager User Guide	Provides information about the use of licenses to gain access to features and functions in ASTRO® 25 systems, including the installation of the License Manager in the system and instructions on using the web-based License Manager user interface to load, view, and manage licenses in the system.

Chapter 1

Interference Locator Overview

Interference Locator is an application hosted on the Unified Network Configurator (UNC), which determines the interfering signal's approximate location and shows it on a map.

Radio Frequency interference can cause repeaters to go out of service with Illegal Carrier detection. This can cause a loss of resource efficiency and a reduction in RF site traffic capacity. Finding the offending RF source can be a challenging undertaking given the coverage area of an RF site. Interference Locator provides a mean by which a system manager can narrow down the location of the offending RF.

The use of the application reduces service downtime and increases availability of channels because interference issues can be resolved more easily. Interference Locator can work with GTR8000 based trunked simulcast systems only (L and M core configurations). In Dynamic System Resilience (DSR) when both UNCs receive a trap, the active UNC receives the incident data and computes the approximate location of the interference, while the data is replicated to the inactive UNC. Detection is limited only to signals located within the receiving radius of at least three GTR8000 based subsites, all part of the same simulcast system site. It has an interference data retention of 250 incidents per site and 2500 per system - see Table 1: Interference Data Retention Limits on page 19.

UNC High Capacity configuration is not supported.

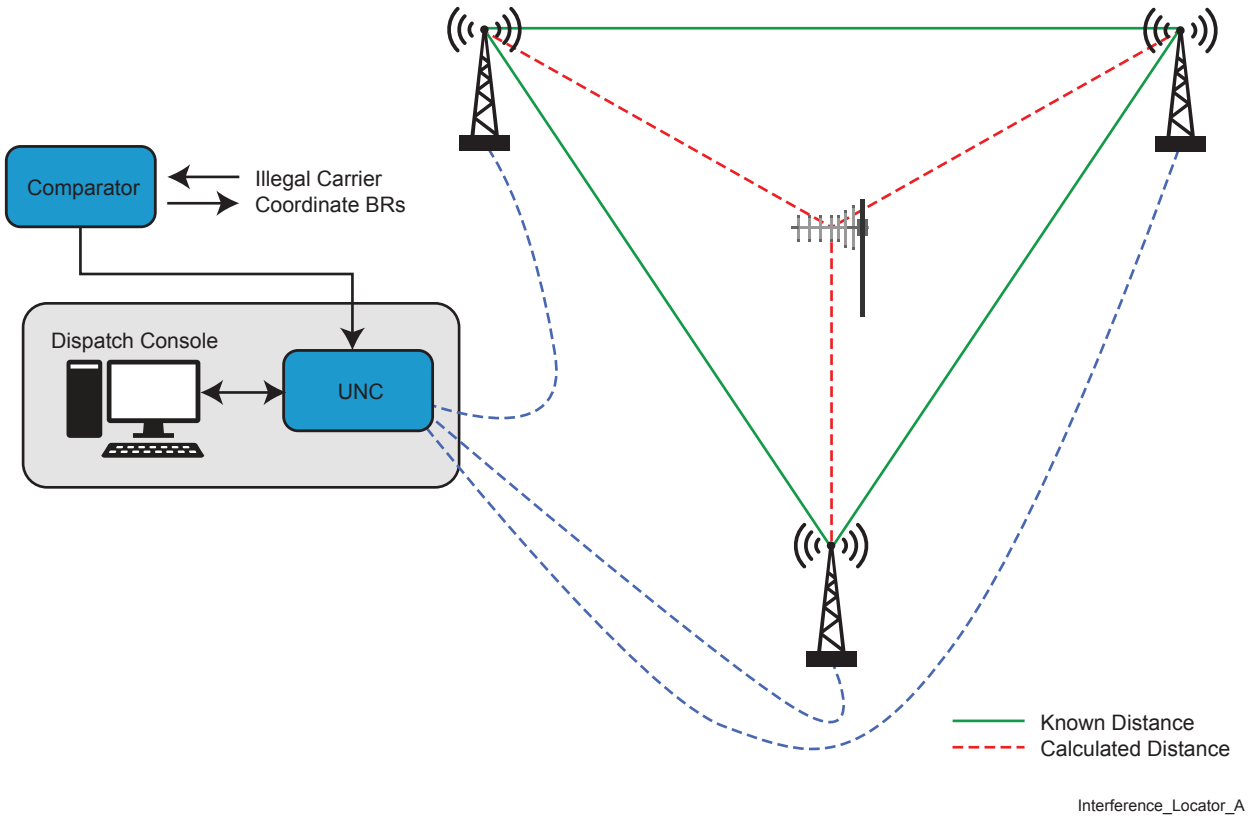
Table 1: Interference Data Retention Limits

	Unprocessed	Processed
Present System Release	250 / 2,500	10,000 / 100,000

The process of detecting the location of an Interferer can be summarized as follows:

- Any Base Radio within a simulcast trunked subsite detects an Illegal Carrier in its channel
- The Comparator coordinates all Base Radios that are part this channel to capture receiver data
- The Comparator informs the UNC of the captured incident
- The UNC collects the receiver data from all Base Radios belonging to this channel
- The UNC processes data and displays the interference location on a map.

Figure 1: Interference Location System Diagram



1.1
Interference Locator Features

Interference Locator provides a means to locate interfering radio sources.

Interference Locator helps you do the following:

- determine the interfering signal approximate location after a base radio detects an illegal carrier
- display the location of interference on a map
- limit the display of interference incidents by time of occurrence
- export the incident data to a KML file

Authentication, Authorization, and Accounting (AAA) function allows systems admins to control which users have access to the ILR application.

1.1.1
Interference Locator Calibration

Calibration is strongly recommended to improve accuracy of Interference Locator feature.

Calibration process requires deliberate emission of interfering signals in the coverage area of the ASTRO® 25 system being calibrated. For each instance of such emission, the exact time and location should be noted, to allow later identification of the triggered events in the UNC Unprocessed Events view. To complete the calibration, you need to add the location data manually to the corresponding, identified logs.

The calibration process may need to be repeated as specified in the following cases related to system expansion:

- Base Radio replacement
- Addition/removal of a channel
- Subsite location change
- Addition/removal of a subsite

Calibration Override

It is possible to omit the calibration process, if less accurate results are acceptable. The errors that the calibration process eliminates are mostly differences in the timing within the Base Radios. If the user accepts a decrease in accuracy of the interference location of tenths of a mile, depending on the location of the interference, the calibration process can be skipped by setting a channel to default calibration.

CAUTION: If you skip calibration, the gathered location data for the interfering signal can be less accurate for interference analysis.

Base Radio Replacement

When a Base Radio is replaced or the radio is changed to another channel or subsite, the new radio cannot use the calibration intended for the retiring Base Radio. The new Base Radio is considered uncalibrated. The channel containing the new uncalibrated Base Radio can be set to default calibration mode for immediate use. The new radio can be calibrated later.

Addition of a Channel

A new channel is considered uncalibrated and the regular calibration procedures for this new channel apply.

Removal of a Channel

Removal of a channel does not affect the system, nor requires any new calibration.

Subsite Location Change

When a subsite location changes, and all Base Radios are calibrated and re-used from the previous location, there is no need to re-calibrate the subsite. The subsite location needs to be updated in the UNC Wizard.

Addition of a Subsite

When a new subsite is added, all Base Radios and channels in the new subsite are uncalibrated. Normal calibration procedure of the subsite apply, all other subsites need not be re-calibrated. This subsite must be calibrated by using the regular calibration procedure. The addition of a subsite does not affect other subsites.

Removal of a Subsite

Removal of a subsite does not affect the system, nor requires any new calibration.

1.1.2 Interference Locator Data Interpretation

The data generated by the processing of a detected Illegal Carrier, also called an incident, requires a minimal level of interpretation.

Data

Table 2: Incident Interpretation on page 22 lists details on how to interpret the data presented in the map view of the Interference Locator to narrow down the location results and to identify the real source of the interfering signal with the highest accuracy.

Each incident is represented as an icon on a map. You can view the following items by hovering the pointer over the incident icon:

Table 2: Incident Interpretation

Item	Explanation
Date	Date of incident
Time (Local)	Time (Local) of incident
Zone	Zone where incident was detected
Site	Site where incident was detected
Channel	RF channel where incident was detected
Frequency	Receiver RF frequency of Channel
Latitude	Latitude of incident
Longitude	Longitude of incident
# of Triangulations	Number of Triangulations measure of quality, the higher the better
Maximum Correlation	Maximum Correlation measure of quality, the higher the better
Average Correlation	Average Correlation measure of quality, the higher the better
Interference Maximum RSSI	Maximum RSSI of all participating subsites
Illegal Carrier Minimum BER	Lowest BER of all participating subsites if interference is APCO 25 modulation
Network Access Code (NAC)	NAC if interference is APCO 25 modulation
Subscriber Radio ID	Subscriber Unit ID if interference is APCO 25 modulation
Rx Protocol	Rx protocol if interference is APCO 25 modulation
Matching Site NAC	NAC matches system or not if APCO 25 modulation

Map

Atmospheric and environmental conditions may cause successive measurement results of the same interference source to vary around the actual location. To mitigate these varying conditions, several measurements are taken on the same interference. Ignore the outliers and average the rest of the measurements visually.

When seeing a cluster of incidents generated by the same interference, to determine the most likely location of the interference average the incidents visually.

For example, you can obtain an accurate average measurement on a 9 subsite system by using the exported file with Google Earth, and by ignoring the "A", "F", and "H" outliers.

The blue star and the interference green target do not normally display. Here they are for illustration purposes only.

Figure 2: Map Visualization

1.1.3

Interference Locator Accuracy

Various factors, like terrain topography, may affect the detection accuracy of the interference location. This section explains the nature of them.

The following factors may affect accuracy:

- Terrain topography
- Atmospheric and vehicle traffic conditions
- Duration of interference
- Power level of interference
- Type of interference
- Calibration accuracy
- Number of subsites
- Location of interference relative to subsites
- Accurate location of subsites

Terrain Topography

The best performance can be obtained in a landscape with minimum obstructions, such as no buildings or low buildings as in rural or suburban areas. Areas with higher obstructions, such as in urban canyons and unusually mountainous terrains, degrade the accuracy of the measurements. The accuracy also depends on the location of the subsites and the height of subsite antennas.

Atmospheric and Vehicle Traffic Conditions

The accuracy of incidents is affected by constantly changing atmospheric conditions, traffic patterns, and individual passing vehicles. This can be partially overcome by taking several measurements on the same interference source and determining their average. Any outliers, can be ignored when visually determining the average.

Duration of Interference

A long lasting interference can allow for several measurements that will contribute to the average of incidents for increased accuracy. The interference need not be continuous and can provide a large number of incidents even if the interference is intermittent.

Power Level of Interference

The power level of the interference is a factor in the determination of its location. Sufficiently high power levels will result in an optimal interference location estimation. Power levels reaching the participating subsites above -110 dBm will result in optimal location determination. The minimum power requirement for at least one participating subsite is -110 dBm, all other subsites can work with power levels as low as -120 dBm.

Type of Interference

Only interference that algorithm was able to determinate location for are presented. A digital interference with high frequency content such as APCO 25 FDMA and TDMA, TETRA, GSM can be more readily detected than analog. Analog FM with Carrier Squelch can not be detected and Analog FM with DPL* or PL* sub-audible coding is highly inaccurate.

*DPL - Digital Private Line - sub-frequency digital code to filter out other radio users.

*PL - Private Line - sub-frequency tone to filter out other radio users.

Calibration Accuracy

Calibration can improve the accuracy of the estimated location of the interference. The level of improvement can vary depending on the delay variations of the receiver hardware involved in the measurement. Also the location of the interference in relation to the participating subsites plays a factor.

As an example of the contribution to accuracy due to calibration using a 9 subsite system in a suburban/rural landscape, the accuracy moves from 0.3 to 0.1 miles. The dark red incidents are determined without calibration and their average is represented by the dark blue star which, in this example, is 0.3 miles from the interference (represented by the green target). The light red incidents are determined with calibration and their average is represented by the light blue star which in this example is 0.1 miles from the true interference on the size of the error reduction.

Figure 3: Example of Improved Accuracy with Calibration

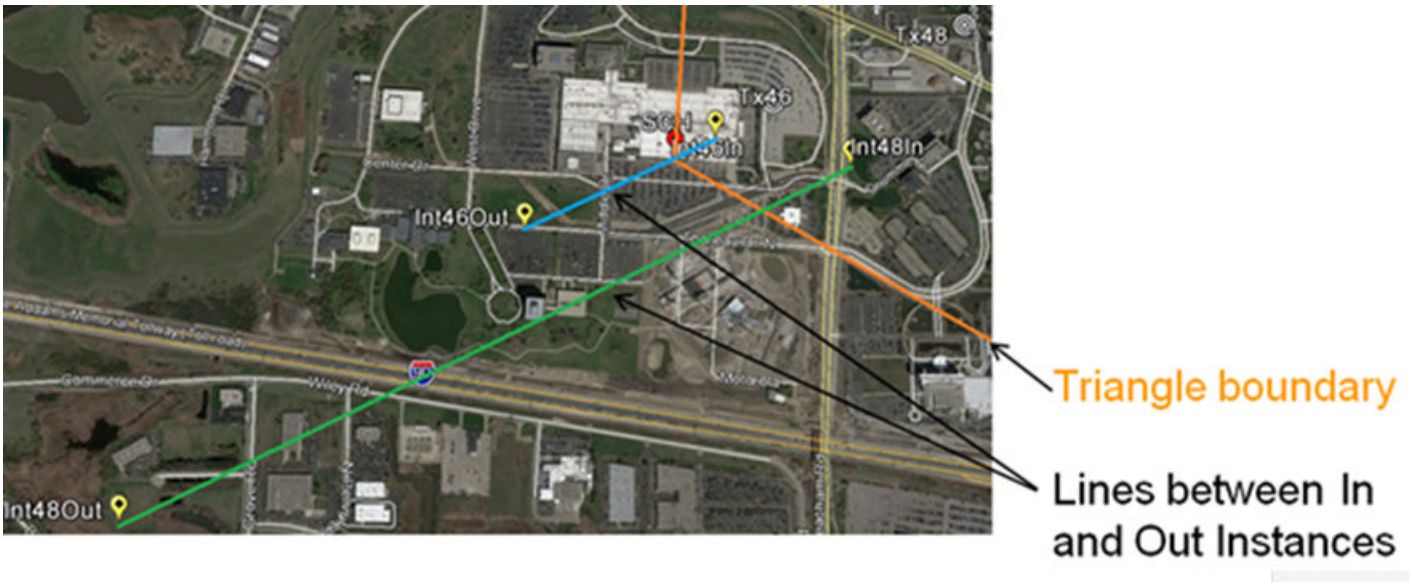
Number of Subsites

To find the location of interference, a minimum of three subsites is required. The higher the number of subsites the better the accuracy of the interference location.

With three participating subsites, and the interference source at specific locations, it is possible the Interference Locator feature is unable to determine the single true location of the interference and provides two possible locations. These specific interference locations are for the most part, but not necessarily, close to a corner of the three subsites. The actual map will not show the lines between the In and Out detections, these are for illustration purposes.

An example of double detection is shown in Figure 4: Example of Dual Detection on page 26 as Tx46 with Tx46Out and int48In and Int48Out:

Figure 4: Example of Dual Detection



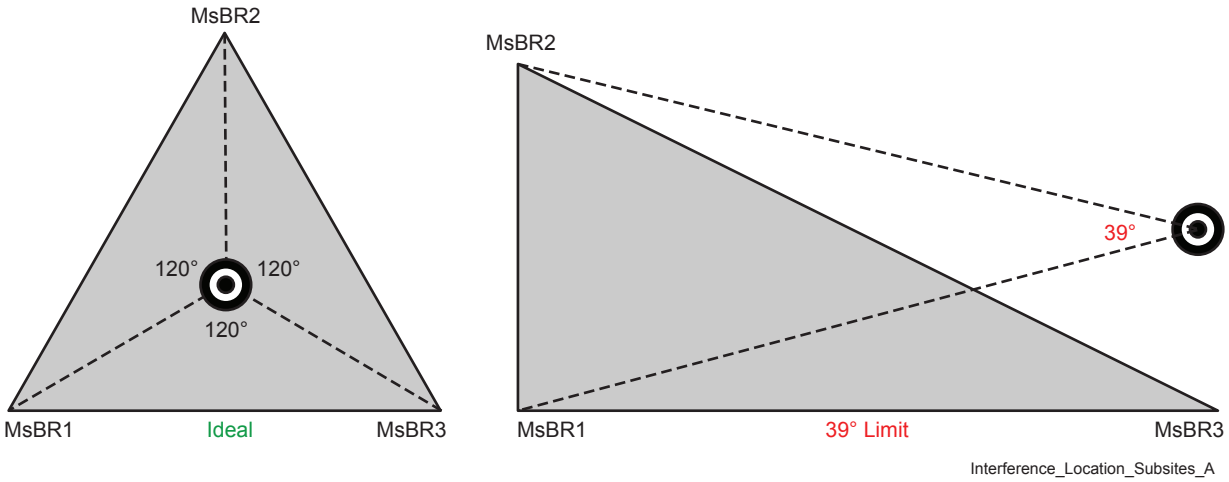
Location of Interference Relative to Subsites

The location of the interference is a factor in the accuracy of the measurements. An equilateral triangle formed by three subsites with the interference in the middle is an ideal location as shown on the left figure.

As shown on the right diagram, the location of an interference that is far away from the subsites experiences degraded performance. The point of degraded performance starts when the angle between the interference and two equidistant subsites falls below 39 degrees. This limitation is more apparent at the edge of the system coverage. In a system with more than three subsites and in a more centric area of coverage, the interference location can be determined by other subsites that are in a better position to determine its location.

Subsites located along a straight line or close to a straight line will have difficulty in accurately detecting the interference locations.

Figure 5: Location of Interference Relative to Sub-Sites



Accurate Location of Subsites

The location of each subsite is used by the UNC analytics in calculating the location of the interference. An inaccurate subsite location in the UNC Wizard at the Site Level Configuration under Site will result in inaccurate calculations of the interference location.

Interpretation of Incident Data Accuracy

The following factors, for each incident or group of incidents, can be used to judge expected accuracy of the interference location.

Table 3: Interpretation of Incident Data Accuracy

Factor	Accuracy Level (low → high)	Comments
Type of Interference	analog → digital	Analog interference not supported in current version.
Number of Triangulations	1 → 56	High number minimizes errors due to multipath.
Number of Incidents	1 → higher	High number minimizes errors from changing RF paths due to atmosphere or obstacles. Recommended mid range is 12 to 24 incidents.
Scatter of Multiple Incidents	wide → narrow	Concentration of multiple incidents on the same area is an indication of higher accuracy. Widespread of incidents is an indication of low modulation content such as Analog with PL* or DPL* or difficult subsite geometries.
Calibration	no → yes	Calibration minimizes errors due to delay differences of system hardware.
Correlation Level	0.08 → 1.0	Correlation level indicates quality of data obtained which may indicate increased accuracy.
Topography	varied → flat	Minimum RF path obstruction results in increased accuracy of measurements.

* PL - Private Line - sub-frequency tone to filter out other radio users.

* DPL - Digital Private Line - sub-frequency digital code to filter out other radio users.

1.2 Interference Locator User Interface

The Interference Locator application is composed of several views.

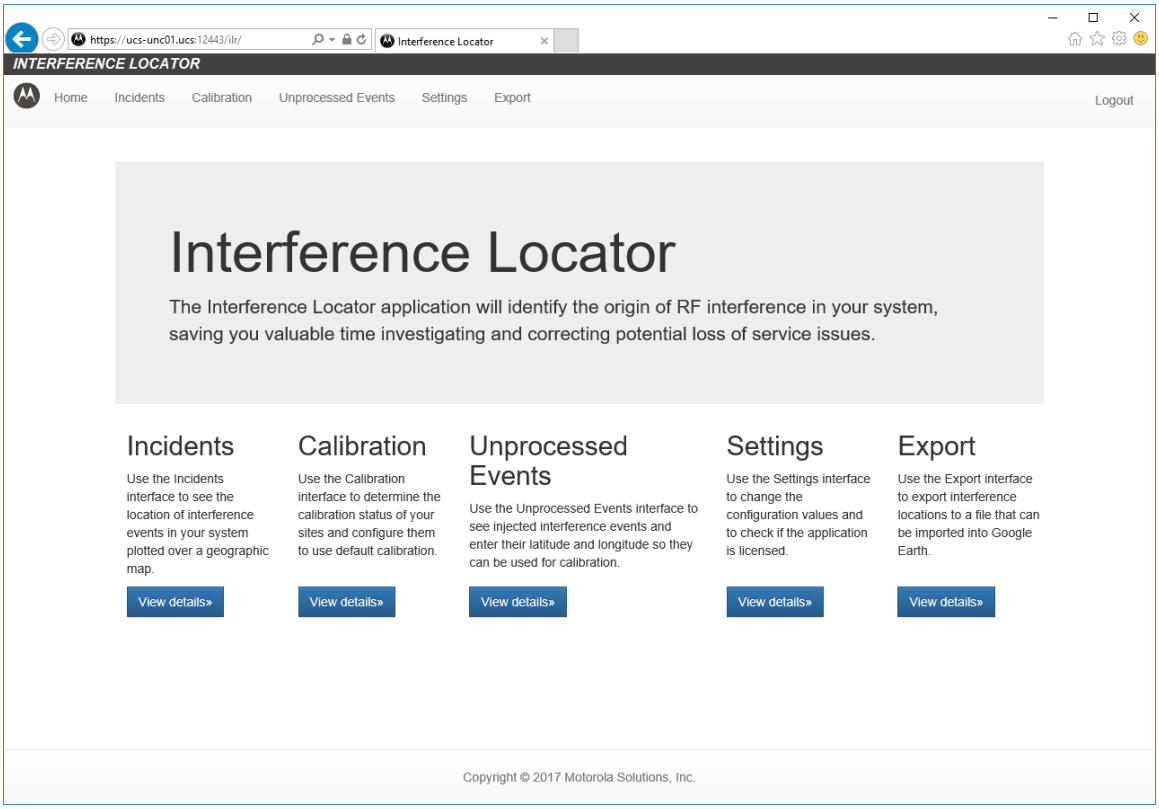
These application views are listed in the following sections with an explanation of their purpose and how to use each view.

1.2.1
Home View

Home View is the landing page for the application. It is the page you see once successfully logged in to the application.

Home View includes paragraphs explaining each of the capabilities/features of the application; Incidents, Calibration, Unprocessed Events, Settings and Export.

Figure 6: Home View

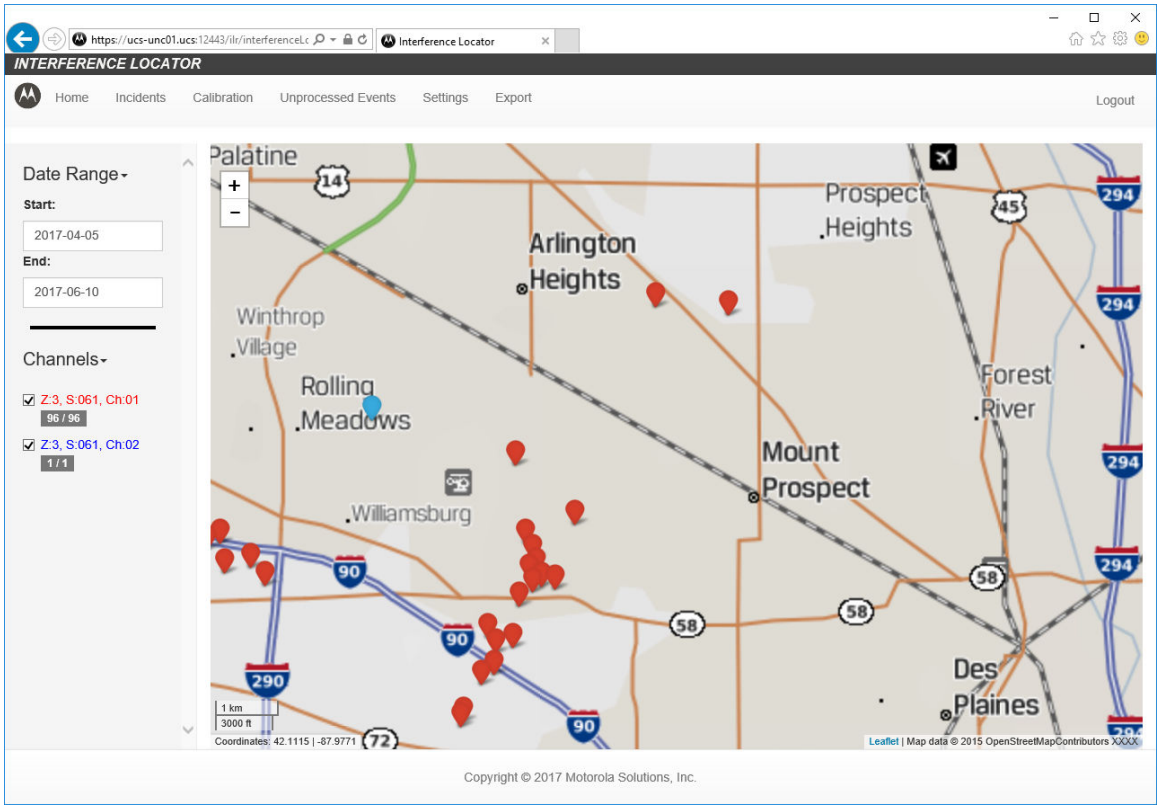


1.2.2
Incidents View

The Incidents view displays the location of all sites in the system as well as calculated interference incident locations over-layered on a geographic map.

You can select the date range of the incidents to be displayed using the Start and End fields on the left. You can also select the channels to be displayed. Map icons are color-coded to reflect the channel of the interference incident. You can select one or more channels to be displayed on the map simultaneously, by clicking on the checkbox in front of the channel list on the left. Note: map tiles must be loaded separately using the GDI tool. The following Figure 7: Incidents View on page 29 shows an example of a map.

Figure 7: Incidents View



1.2.3
Calibration View

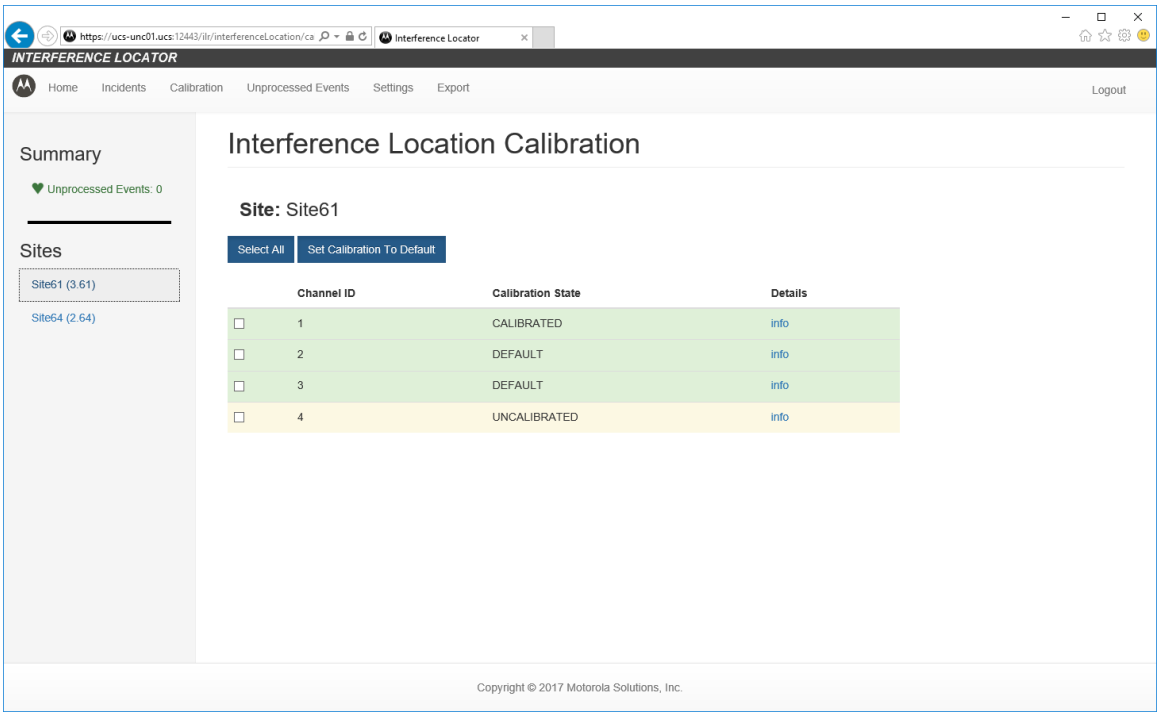
Calibration View displays the current calibration status of the system as UNCALIBRATED, DEFAULT, or CALIBRATED.

The upper left portion of the screen displays a summary of the number of Unprocessed Events. By selecting a site on the lower left portion of this view, you can see the list of channels for that site and the calibration status of each channel. From this list, you can select a channel or channels, and click on the **Set Calibration To Default** button to change the calibration status to default calibration. Channels with default calibration can be used to process events but channels with UNCALIBRATED state cannot process events.

This view also allows access to the Channel Calibration Status screen to view the details of the calibrations in process by clicking on the **Info** link. In order for a channel to be calibrated, a sufficient number of injected events must be processed. This screen allows you to see the results of previously processed events to determine the appropriate location to inject additional events to specific channels and subsites, in order to complete the calibration process.

The maximum number of displayed incidents from the scheduled period is 1000.

Figure 8: Calibration View

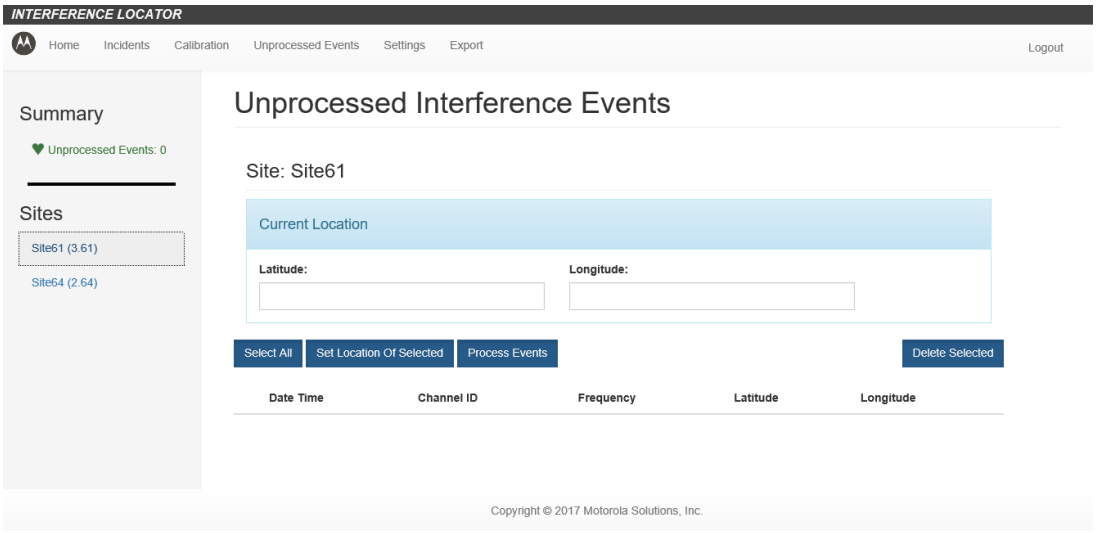


1.2.4
Unprocessed Events View

Unprocessed Events View displays a list of unprocessed events. Unprocessed events are either events that were injected manually for calibration purposes, or real interference events that cannot yet be processed because the corresponding channel has not been calibrated, nor has the channel been set to use default calibration.

From this interface you can select a site on the left, and see the list of unprocessed events displayed at the bottom. You can select an event that was manually injected, enter the appropriate Latitude and Longitude values in the upper portion of the screen, and apply these values to the event. These values will be utilized by the Calibration process by selecting the events and pressing the **Process Event** button.

Figure 9: Unprocessed Events View



1.2.5
Settings View

The Settings view allows to view and modify parameters used in the analysis of the incident data to determine the location of the incident.

The Selectivity value has a default value of 0.08 and a range of 0.08 to 1.0. It is used to determine the lowest quality of individual incidents that are acceptable for display. Increasing the selectivity value results in fewer incidents but with higher quality. The Minimum RF RSSI field has a default value of -110.0 and a range from -110.0 to 0.0.It is used to determine the lowest power level acceptable to compute individual incidents. This value is only applicable to the highest RSSI value of all the sub-sites, all other sub-sites can have an RF RSSI value down to -120 dBm to participate in the computation of location. Increasing the RF RSSI will result in fewer incidents but with higher quality. These values should not be modified from their default values without the consultation of an expert.

If there is a high number of interference sources detected, one may increase the RSSI threshold in the Settings View to screen out lower power interferences and focus first on the higher power interference.

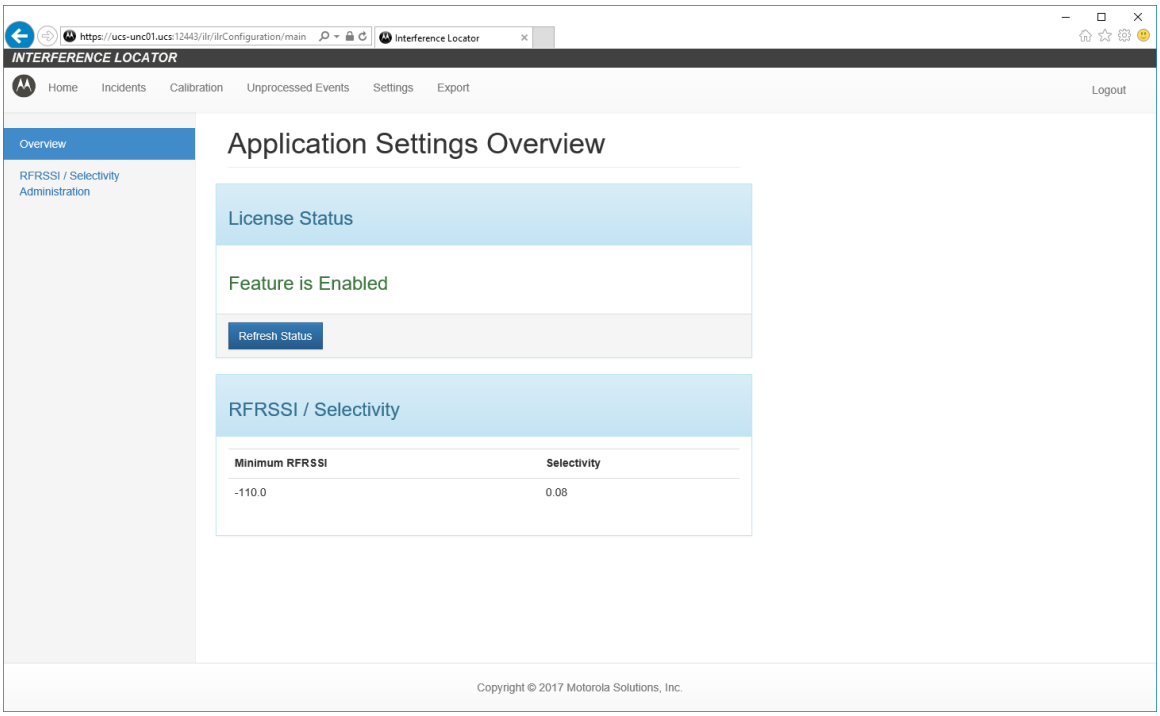
To update the values, click on the **RFRSSI / Selectivity Administration** menu option on the left, and then tab to or click in the desired field and modify the value. Click on the **Submit** button to save the modified values.

The minimum RSSI used is also dependent on the Illegal Carrier RF Threshold Value found under the Station Configuration via Base Radio CSS. The highest power of these two RSSI values establish the low power threshold of the illegal carrier that can be detected since an Illegal Carrier event has to be generated to prompt the Interference Locator incident.

Additionally this view displays the current License Status of the application and allows you to refresh this status. Refreshing the status is only necessary when a license has been added/updated/deleted on the License Server after the Interference Location application has been enabled.

To refresh the License Status, click on the **Overview** menu option on the left, and then click on the **Refresh Status** button. The system retrieves and displays the new License Status.

Figure 10: Settings View

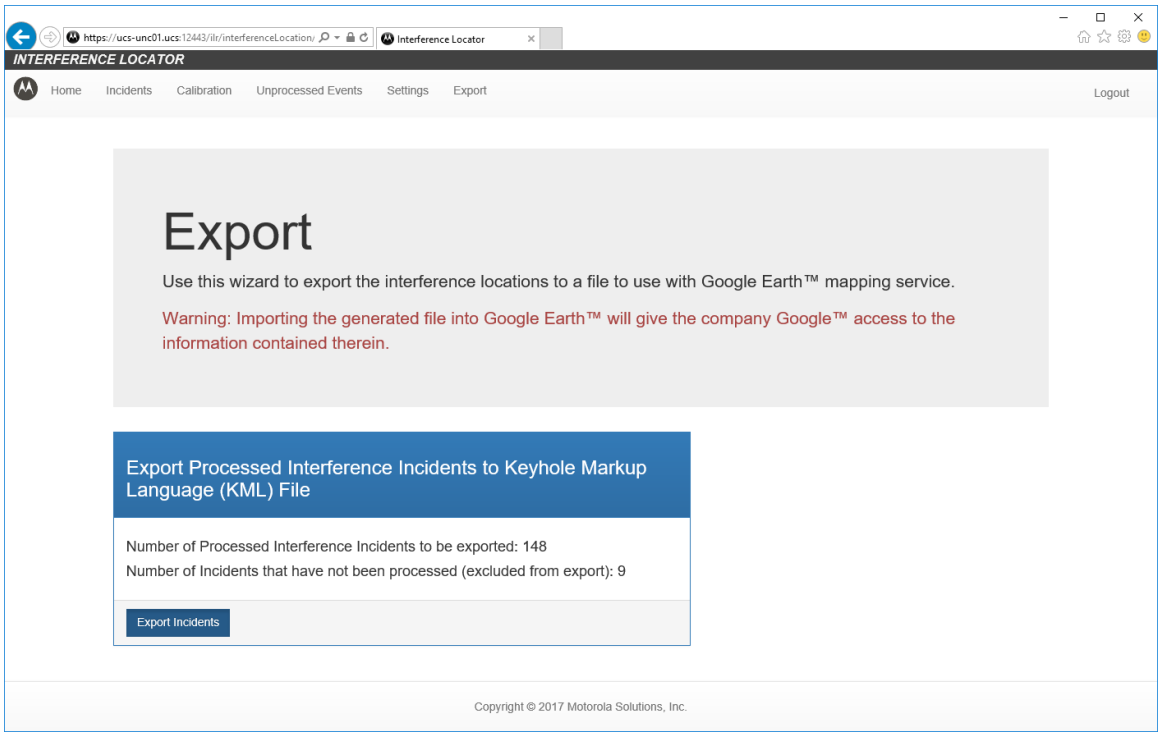


1.2.6
Export View

Export View provides the ability to export the interference locations to a Keyhole Markup Language (KML) file to be used with the Google Earth mapping services for increased map resolution and portability.

The view shows the number of interference events to be exported. See Exporting KML Files on page 41.

Figure 11: Export View



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Chapter 2

Interference Locator Installation and Configuration

This chapter contains information on how to implement the Interference Locator feature in the system.

Interference Locator is installed along with the UNC and the site software and only needs to be enabled and configured. (Interference Locator is available only after applying UNC box release updates). No specific installation procedures are necessary.

2.1 Enabling Interference Locator

To enable the Interference Location feature in your system, set the system-level parameters in the UNC Wizard and configure the Base Radios for illegal carriers detection. Basic Interference Location functionality is license-free. To access the advanced options, you must obtain a feature license.

Prerequisites:

IMPORTANT: Do not enable Inference Locator Feature for a Site before uploading license on the License Manager.

Enable SNMPv3 Authentication and Privacy (AuthPriv) settings for the site equipment. See “SNMPv3 Configuration” in the *SNMPv3 User Guide*.

Define the location of the sub-sites in the UNC Wizard at the Site Level Configuration under Site or by using the GDI tool to import the locations from a `.csv` file. The location of each sub-site is used by the UNC analytics in calculating the location of the interference. An inaccurate sub-site location in the UNC Wizard will result in inaccurate calculations of the interference location.

Procedure:

1. Obtain the appropriate licenses for the Interference Location analytics feature. See the *License Manager User Guide*.

   Without the license, you can calibrate the Interference Locator, therefore enabling the system to gather the interfering signal location. No interpretation of the gathered data to provide the locations for the interfering signal is possible in such a case.

2. In the UNC Site Wizard, enable the Interference Locator feature and set the Hold Off Timer parameter.

   The Hold Off Timer allows you to adjust the minimal time between interference location sample events. (range of 10-1200 seconds; default = 60 sec)

   A very low value of this parameter may result in multiple incidents from the same source being reported too frequently and thus not providing the UNC with enough time to upload all the incidents, resulting in event failures. The recommended minimum value of the Hold Off Timer is 45 seconds plus 5 seconds per sub-site to give the UNC time to upload the files and avoid file overwrite at the Multisite Base Radio (MsBR). You can use the Hold Off Timer to minimize the number of incidents collected from the same interference by using a higher value.

3. Connect to the Base Radio with Configuration/Service Software (CSS) by the Ethernet connection.

4. In CSS, go to **System** → **Site** → **Subsite** → **Configuration**.

5 Verify that Enable SFTP transfer protocol found in the Base Radio CSS station configuration is enabled.

6 In the **Configuration** window, select the **Station Configuration** tab and perform the following actions:

   a For the **Illegal Carrier Determination** option, select **Enabled**.

   b In the **RF Threshold Value (dBm)** field, enter the minimum signal strength (RSSI) above which the Base Radio considers the received signal to be an illegal carrier.

      The default value is -90 dBm.

   c In the **Malfunction Timer Value** field, enter the minimum time that an illegal carrier must exceed the threshold value before the Base Radio disables the channel.

      The default value is 50 seconds.

   If the Base Radio detects an illegal carrier and disables the channel, an Interference Location Incident is generated.

7 Enable user to login to application, add the user to interfere_locator group on Domain Controller.

Related Links

Interference Locator License on page 36
Interference Locator Backup and Restore on page 36

2.2 Interference Locator License

The Interference Locator is a licensed feature.

You can access all views and see unprocessed interference events, but processing events is only possible when the feature has been licensed. To license the Interference Locator feature, add the appropriate license to License Manager. For more information, see the *License Manager User Guide*.

Related Links

Interference Locator Backup and Restore on page 36
Enabling Interference Locator on page 35

2.3 Interference Locator Backup and Restore

The Interference Locator data is incorporated into the Unified Network Configurator (UNC) server backup and restore.

All incidents, calibration results, and settings are backed up whenever the UNC server is backed up. A restore of the UNC database also restores all the incidents, calibration, and settings that were in place when the backup was completed.

Related Links

Enabling Interference Locator on page 35

Chapter 3

Interference Locator Operation

This chapter describes how to use the Interference Locator feature to calibrate the interference analysis components and analyze the interference signal location data. The actions aim to provide higher system availability.

3.1 Logging into Interference Locator

Follow this procedure to log into Interference Locator.

Prerequisites: Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application.

Procedure:

1. Launch Internet Explorer and go to `https://ucs-unc0<x>.ucs:12443/ilr`

   Where **<x>** is 1 or 2 based upon which Unified Network Configurator (UNC) is the active UNC.
2. In the Interference Locator login window, enter your username and password.

3.2 Calibrator Operations

This section describes how to calibrate the Interference Locator application, so that it provides increased accurate location data of the interfering signal.

To calibrate a channel or channels, the channels need to be disabled to normal traffic to avoid interference with the calibration process.

Calibrating the Interference Location feature is needed for the Interference Locator feature to calculate a more precise location. All channels at all sites need to be calibrated, and therefore the process may be time-consuming.

Calibration can be performed by one person. However, time can be saved by having one person generate the calibration interference instances while a second person processes the incidents at the UNC and provides guidance as to what channels and sub-sites need more calibration interference instances. With two persons, steps 2 and 8 can be done simultaneously without excessive event generations.

3.2.1 Calibrating Interference Locator

Use this procedure to calibrate Interference Locator. Repeat the procedure multiple times on each channel to cover all subsites and for each RF site within the multi-site system.

Prerequisites:

IMPORTANT: Perform calibration or set default calibration soon after enabling the feature for the site.

Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application.

Procedure:

1. Transmit RF interference with a mobile (recommended) or portable radio at pre-determined locations, in accordance with the following rules:
   - Interfering Radio - this radio can be configured as a conventional radio with a NAC (Network Access Code) that does not match the system NAC and transmits on the inbound RF frequency of the channel under test.
   - UNC Interference Locator Settings view - leave the Selectivity as default value of 0.08 and the Minimum RF RSSI field has a default value of -110.
   - MsBRs - Set the Illegal Carrier Detect level to -110 dBm and **Malfunction Timer Value** to 5 seconds on all participating MsBRs via the UNC. These parameters can be found in the **Base Radio CSS → Station Configuration → Illegal Carrier Determination (default = -90 dBm) and Base Radio CSS → Station Configuration → Malfunction Timer Value (default = 50 seconds)**.
2. Generate Calibration Incidents

   Using the interfering radio, transmit in the middle of the coverage area of participating subsites for 12 seconds while not moving. Do not transmit near any sub-site location. Record the latitude, longitude and start time (hh:mm:ss) using a smart phone GPS application or similar. A copy and paste of the location and time stamp to a document works very well.
3. Wait at least the hold-off time, counting from the start of the transmission to give the UNC time to upload the files and avoid file overwrite at the MsBR.
4. Repeat step 1 and step 2 at least 20 times at locations at least a 1/4 block (50 meters, 55 yards) away from each of the previous transmissions or until the trio or trios of subsites show sufficient calibration events, that is greater than 6/12. This is one set of transmissions. This is done for each channel under calibration. Doing all channels and locations at the same time saves calibration time.
5. Record the latitude and longitude of each interfering transmissions to be used to associate the incident location to the incident recorded at the UNC using the time stamps.

   NOTICE:
   Using a portable instead of a mobile for calibration will require more data locations and points and will significantly increase the calibration time.

   For larger sites with 5+ sub-sites, more than one set of transmissions at different locations might be needed to reach all sub-sites with a power level sufficient for calibration. Use the Interference Locator Calibration Wizard to obtain feedback on what sub-sites need more calibration interference events.
6. In the Interference Location application, log in as Calibrator.
7. In the Unprocessed Events view, select the site from the side bar.

   Interference events associated with this site are displayed.
8. Add the location for the events that are being used for calibration:
   a. Click the check box on an incident intended for calibration to enter its location.
   b. Enter the latitude and longitude for the injected event and associate with the time stamp, take into account that the smart phone time stamp and UNC time stamp may be offset by a few seconds when matching incidents with locations.
   c. Click the **Set Location of Selected** button to update the location for the selected event.
9. Select all instances with entered locations, after all event locations have been added.
10. Click the **Process Events** button to process the events to calibrate the channels.

11 Under the tab “Calibration” analyze the calibration results for every channel (CALIBRATED vs. UNCALIBRATED).

For those channels that remain UNCALIBRATED, observe the number displayed as k/n. The k/n number required for calibration is 6/12, meaning it is required to have at least 12 valid interference instances (n) and 6 interference instances (k) remaining after processing. Example of incomplete calibration would be 3/15, 0/11, 2/20.
A successful calibration result would display a single line with the calibration result under the “info” page. Two or more lines means that there are not sufficient events linking all trios and the two or more subgroups of subsites require additional interference instances. The number of k instances will remain zero until the number of valid instances n is 12 or more.

The presence of actual interference during calibration can sabotage calibration for those sub-sites experiencing the strongest interference. The presence of receiver alarms or reference alarms or timing alarms on a given Base Radio will block the Base Radio from collecting new incidents for that channel.

3.2.2
Decalibrating a Single Base Radio

Prerequisites: Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application.

CAUTION: This action permanently removes calibration data for selected Base Radio(s).

Procedure:

1 In the Calibration view, select the Site in question.
2 For the channel in question click on the “info” link.
3 Select **Decalibrate and remove Calibration data for Base Radios**.
4 Select the subsite where the BR to de-calibrate is located.
5 Press the **Decalibrate Base Radio(s)** red button.

A message from webpage appears.

6 Click **OK** on the message.

The Base Radio and corresponding channel now goes from CALIBRATED or DEFAULT to UNCALIBRATED and calibration data corresponding to this participial base radio is gone.

Postrequisites: To calibrate the new radio, follow calibration procedures to inject calibration interference instances. There is no need generate instances to calibrate all radios.

3.2.3
Recalibrating a Whole Channel

You have an option to return a site, a sub-site or base radio to an uncalibrated state. This is useful when previous calibration results were not satisfactory, or you initially used the calibration override capability, but would like to calibrate now. You can set Channel to uncalibrated state and enable additional calibration data collection to improve feature accuracy.

Procedure:

1 In the Calibration view, select the Site in question.
2 For the channel in question click on the “info” link.
3 Select **Decalibrate Channel**.

4 Press **Set Channel to uncalibrated** red button.

A message from webpage appears.

5 Click **OK** on the message.

The whole channel now is uncalibrated. (Previous calibration data remains. You can collect new calibration data samples for improved interference locator accuracy).

Postrequisites: To calibrate the whole channel again, follow calibration procedures to inject calibration interference instances to all base radios in the channel.

3.2.4
Decalibrating and Removing Data for a Whole Channel

In case where previous calibration data was not sufficient, or a multiple hardware replacement took place, you can recalibrate and remove previous calibration data for the whole site.

Prerequisites: Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application.

CAUTION: This action permanently removes collected calibration data for a channel.

Procedure:

1 In the Calibration view, select the Site in question.
2 For the channel in question click on the “info” link.
3 Select **Decalibrate and remove Calibration data for Base Radios**
4 Select all the Subsites.
5 Press the **Decalibrate Base Radio(s)** red button.

A message from webpage appears.

6 Click **OK** on the message.

The Base Radio and corresponding channel now goes from CALIBRATED or DEFAULT to UNCALIBRATED.

Postrequisites: To calibrate the new radio, follow calibration procedures to inject calibration interference instances. There is no need generate instances to calibrate all radios.

3.2.5
Overriding Interference Locator Calibration

Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application.

Procedure:

1 In the Calibration view, select the Site in question.
2 Select the channel or channels to override calibration.
3 Click **Set Calibration to Default**.
4 The channel should now go from “UNCALIBRATED” to “DEFAULT”

You need to refresh the screen.

3.3
Locator Operations

See Table 2: Incident Interpretation on page 22 for details on how to interpret the data presented in the map view of the Interference.

3.3.1
Viewing Interference Incidents Details

Prerequisites: Calibrate the Interference Locator application. See Calibrating Interference Locator on page 37.
Ensure the user account you want to use to access Interference Locator is assigned to the group with permissions to use the application. Click on **Interference Incidents** tab.

3.3.1.1
Filtering Displayed Incidents

The wizard provides the means to narrow the display to incidents occurring within a specified date range as well as on specific channels.

When and where to use:
Use the Incidents tab to display the locations of frequency interference on a map. Use the provided date-pickers to select the Start and End date ranges. Uncheck the channels for the incidents you would like to remove from the display.

If the map is showing as gray, then map tiles need to be loaded via the Geographical Data Importer (GDI) as specified in the "Uploading Map Tile Files via GDI" section of *Unified Network Configurator User Guide*.

Procedure:

1. Click on **Interference Incidents** tab.
2. Enter the start and end dates for your search.

3.3.2
Exporting KML Files

This procedure explains how to export processed interference incidents to Keyhole Markup Language (KML) files.

Procedure:

1. In **Export** view, click **Export Incidents** button.
2. Save the `.kml` file in a preferred location.

3.3.3
Viewing KML Files

This procedure explains how to view the KML files in Google Earth application.

Prerequisites:
Download and install Google Earth application from the Google Earth website.

WARNING: Importing the generated file into Google Earth will give the company Google access to the information contained therein.

Procedure:

1. Launch Google Earth application.
2. Click **File** → **Open** and choose the file you wish to view.

Chapter 4

Interference Locator Troubleshooting

This chapter provides any applicable scenarios for Troubleshooting the Interference Locator application.

When there is a high level of failure of the generated incidents for calibration for a specific channel and specific sub-site, it is possible that there are actual interferences that prevent the Base Radio from properly calibrating.

If the interference is strong enough to reach other sub-sites, place the Interference Locator under DEFAULT calibration and search for the interference.

If the interference is too weak to reach other sub-sites, verify the presence of an interference via Base Radio CSS RSSI measurements, and search manually for the interference around the failing sub-site.

The presence of receiver alarms or reference alarms or timing alarms on a given Base Radio blocks the Base Radio from collecting new incident data for that channel. The user needs to resolve these Base Radio alarms before proceeding to calibrate or use the Interference Locator feature.

When channels are in fail soft mode, interference is not detected. This may happen more readily for a two channel system.

When interference is present on the control channel and the control channel is disabled, a different channel (if available) is assigned as a control channel. Once the original control channel is disabled due to interference, then the interference location is detected. Similarly, the Interference Locator is not activated when interference is present on voice or data channels until the channel is disabled.

In case of continuous interference on many channels multiple related jobs on UNC server may be observed. Interference Locator`s jobs may delay other normal (not low priority) operation execution on UNC. In such cases, interference sources should be eliminated, or Interference Locator Hold Off Timer parameter should be increased or interference location feature shall be disabled for interfering sites

The sites should have all devices setup to secure SFTP transfer mode for the UNC to upload the Interference Locator data files.

If the interference is an analog FM or AM interferer without low level signaling such as PL or DPL, the Interference Locator does not detect it. Use traditional means of locating the interference. If the interferer is an analog signal with PL or DPL the detection may not be sufficiently accurate to provide actionable information.

Sometimes after hovering or refreshing action the information provided in tool tip is not readable. In such case refresh the page or reopen it in a new window browser.

After channel recalibration no information about channel calibration samples data is presented.

If the Interference Locator feature was enabled without licenses or a channel remains uncalibrated for a long period of time processing interference data from BR may be disturbed. New interference incidents are not processed. In such case please contact Motorola solutions support for recovery procedure.

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Chapter 5

Interference Locator Disaster Recovery

This chapter provides the Disaster Recovery instructions for the Interference Locator application.

The raw incident data, calibration data, sub-site locations and the processed incident data shall be backed up and restored during the UNC servers backup and restore operations. See the *Unified Network Configurator User Guide*.

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