LHR
(Line Health Recorder)
User Guide

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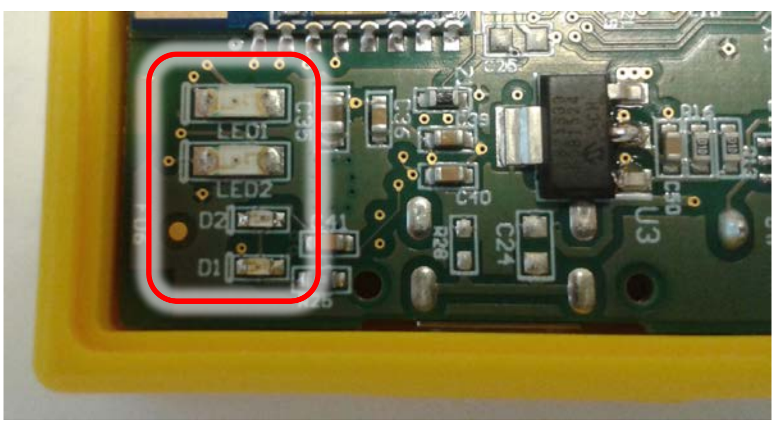
1 — Introduction

The LHR (Line Health Recorder) retrieves status from recording devices via radio with no user interface. This allows an efficient quality control of the spread without assigning dedicated personnel for this operation.

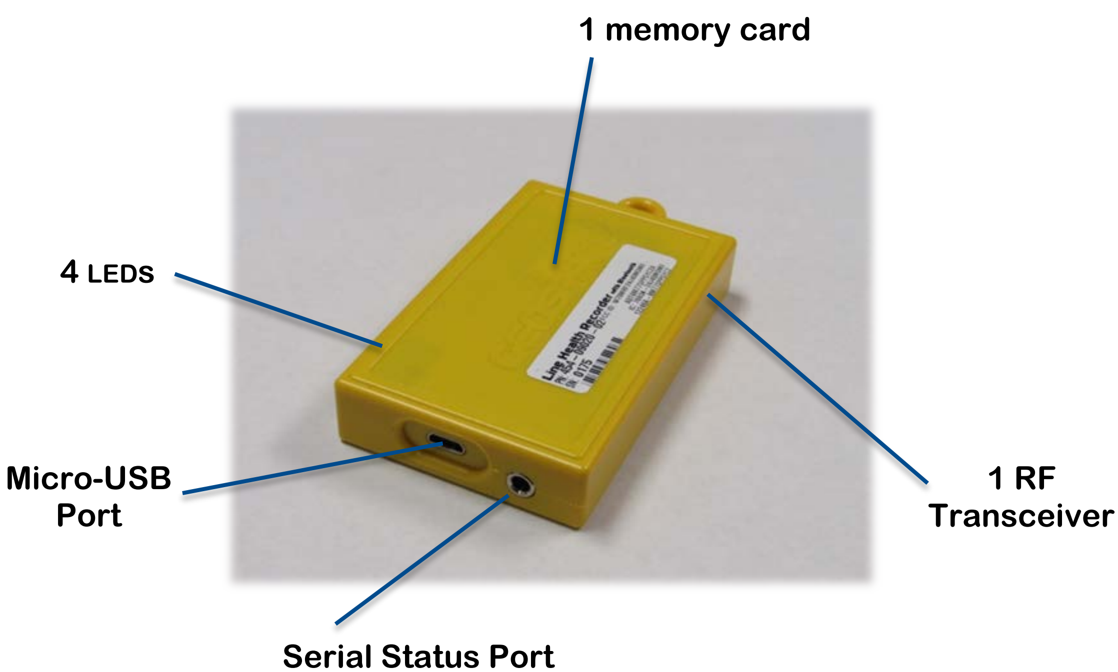
The LHR features:

- One Micro-USB port to charge the internal battery and to interface with the device files (binary and radio text files).
- 4 LEDs observable through the case to show radio transmission, reception of status, health of USB connection, and charging process.



- One removable battery (Lithium Ion 3.7 Volts 1000 mAH).

- One RF transceiver module (set to 10 dBm) for communication with recording devices.
- One removable 16 GB microSDHC flash memory.



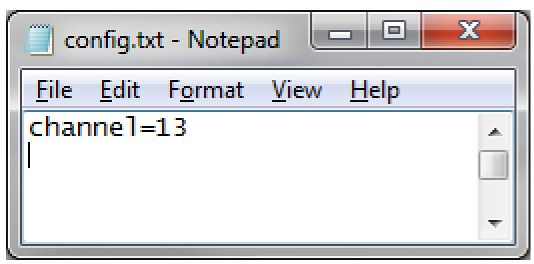
2 — Settings

When connected to a computer, the LHR will appear as a removable USB memory device. The following files should be present in its root directory:

- **Prgrxxx.bin** LHR firmware program file.
- **LHR.log** Shows unit serial number, boot version, USB code and radio firmware currently installed in the LHR.
- **Config.txt** Channel selected for communication with recording devices.
- **593-01650-01_x_Manual, LHR User Guide** This document.
- **593-01650-02_x_LHR QuickStart Sheet**

2.1 – Selecting radio channel

The LHR radio channel should be programmed with the same channel the recording devices are using for radio communication. To change radio channel, connect the LHR to a computer USB port and open the **config.txt** file available in the root directory.



Type the desired channel number after "**channel=**" and save the file.

> **Note:** At least one carriage return <Enter> should be added after the channel number.

2.2 – Updating firmware

To update new firmware in the LHR, place the newer **Prgrxxx.bin** file in its root directory. Next time the unit goes through boot up, the software is automatically updated.

3 — Operational Modes

Depending of the connection, the unit has three operational modes:

- **USB mode**: The LHR stops radio transmissions and allows the user access to internal memory.
    - **Device Interface Mode**:
- **Radio mode:** The LHR is establishing communications to available recording devices.
- **Sleeping mode:** The LHR turns itself off when the battery voltage is lower than 3.2 Volts.

3.1 – USB mode

The LHR will automatically switch to this mode when the unit is connected to a computer (or charger) USB port and a valid connection is detected.

This mode is used to transfer files between LHR and the connected computer. It also allows charging of the internal battery.

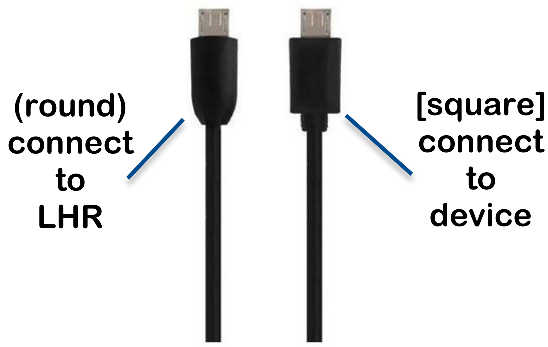
The LHR connection to any USB port or charger will show the following LED codes:

- D1 Green: Good power source.
- D2 Red: Battery is charging; it will turn off after battery is fully charged.
- LED1 and LED2 blink intermittently to indicate that the LHR processor is running and has a good handshake with computer through USB port.

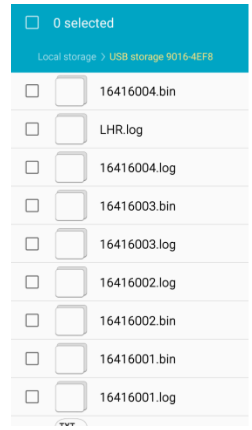
Once the battery is fully charged, it provides typically 8–12 hours of continuous operation. The battery can be easily replaced in the field by removing the back side of the case.

3.1.1 *Device Interface Mode*

Using the supplied “On-the-Go” cable, connect the LHR to an Android cell phone, tablet, or device.



Micro USB to Micro USB OTG (On-The-Go) 12" (30cm) Data Cable



LHR’s files accessed on Android device

Once connected to the Android device, the files on the LHR can be accessed and transferred to the device, where they can be sent via email or text-message.

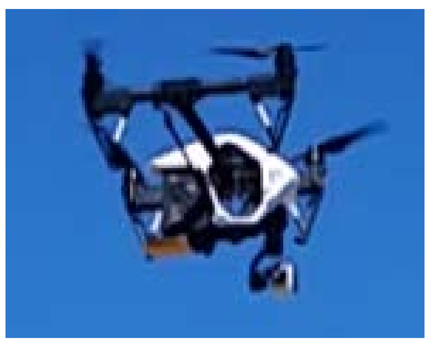
3.2 – Radio mode

As soon as the unit is disconnected from a USB port, the LHR switches to continuous radio operation mode, and LED2 shows two quick flashes per second:

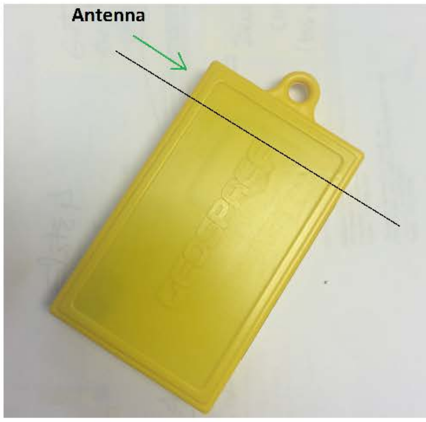
The recording device turns on its radio one second every ten seconds. If messages from LHR(s) are acknowledged, a “quick status” message is sent out; when LHR(s) receive this status the LED1 blinks once indicating that a valid data stream has been received.

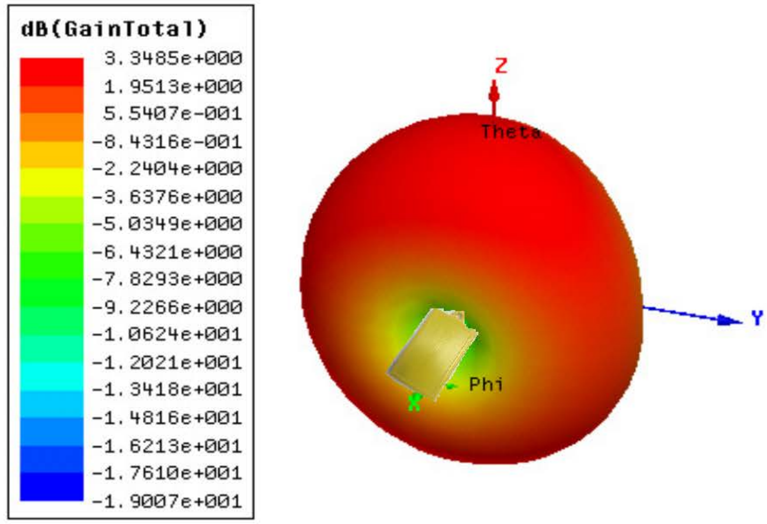
If radio communication between LHR and recording devices continues to occur, the LHR requests them to send new status every ten seconds.

Once in the field, LHRs can be located in any vehicle or hand carried by field personnel.



The LHR Antenna, located on the opposite side from the USB connector, has a simulated 3D radiation pattern as shown:





3.3– Sleep mode

LHRs automatically switch to sleep mode when the battery voltage is below 3.2 Volts. All LEDs turn off.

4 — LMC or GeoMerge operation

4.1 – Extracting files from LHRs

Files are updated when status is collected from recording devices; they are available in the root directory:

- **ssscnnn.bin** has quick status information previously collected from recording devices.

  The first three characters of the file name correspond to the LHR **s**erial number, the next two characters are the radio **c**hannel numbers, and the final characters are **n**umerals which increment when a new session is acquired.

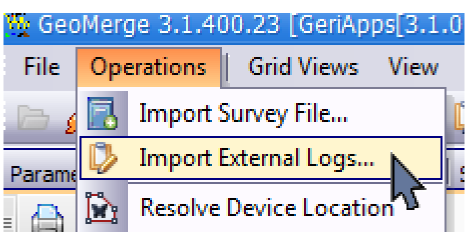
- **ssscnnn.log** shows log information, including recorded packages, errors (if any), battery voltage, time, and the reason why the file was closed. The example below shows typical information included in the log:

```
RecErrFlg=00 pktLenErr=0000 utErr=0000 txErr=0000
time:08hr 40min 00sec batt_volt=3310
allPkt=3142 myPkt=3142 recCnt=3142 recErrCnt=0
RecErrFlg=00 pktLenErr=0000 utErr=0000 txErr=0000
rec_stop:2010-1-1:9-33-54 batt_volt=3086

file_closed by batt_low.

the end of log file
```

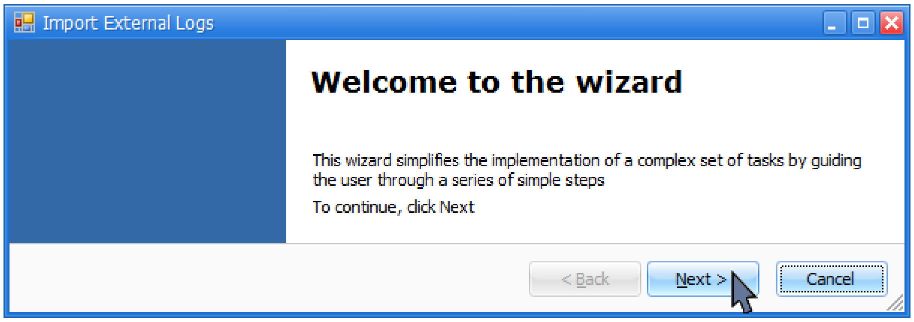
Files can be copied locally to any location in GeoMerge or LMC servers to be imported later.

4.2 – Importing binary LHR files to LMC or GeoMerge software

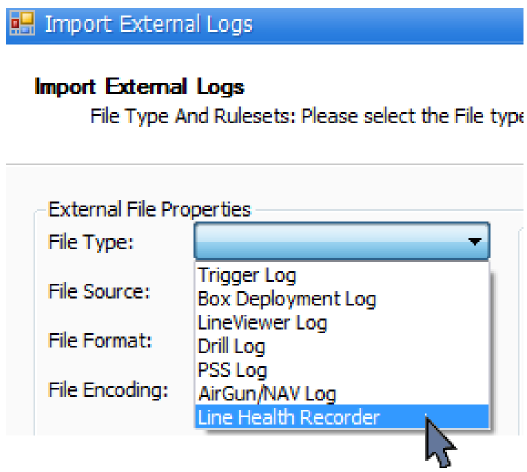
To import LHR files, click on **Operations > Import External Logs…**



In the Welcome window, click **Next**.

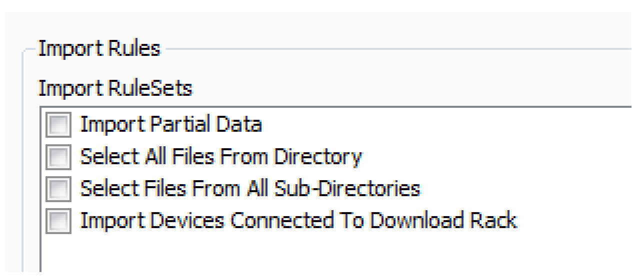


In Import External Logs window, for the **File Type** select **Line Health Recorder**.



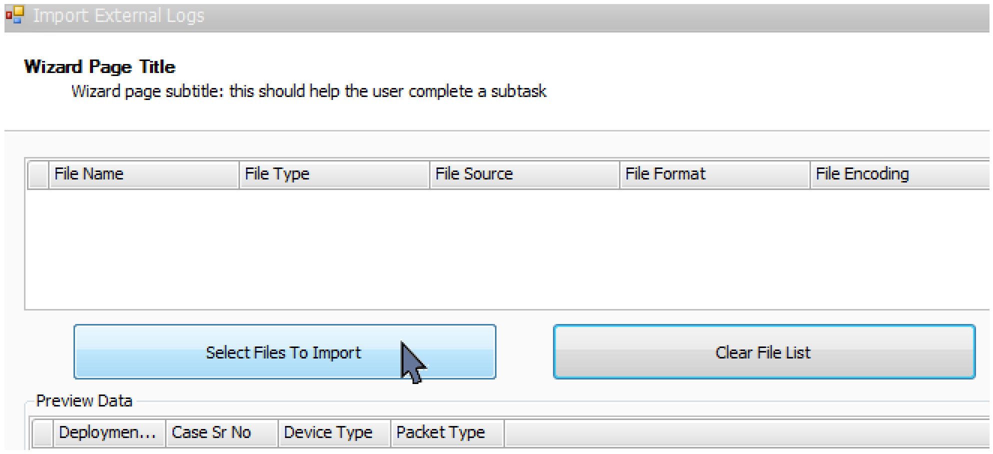
In the Import Rules section, available options for LHR are:

- **Select All Files From Directory**: select this if you want to import all files available in the selected directory.
- **Select Files From All Sub-Directories**: select this if you want to import files from all sub-directories available in the selected folder.

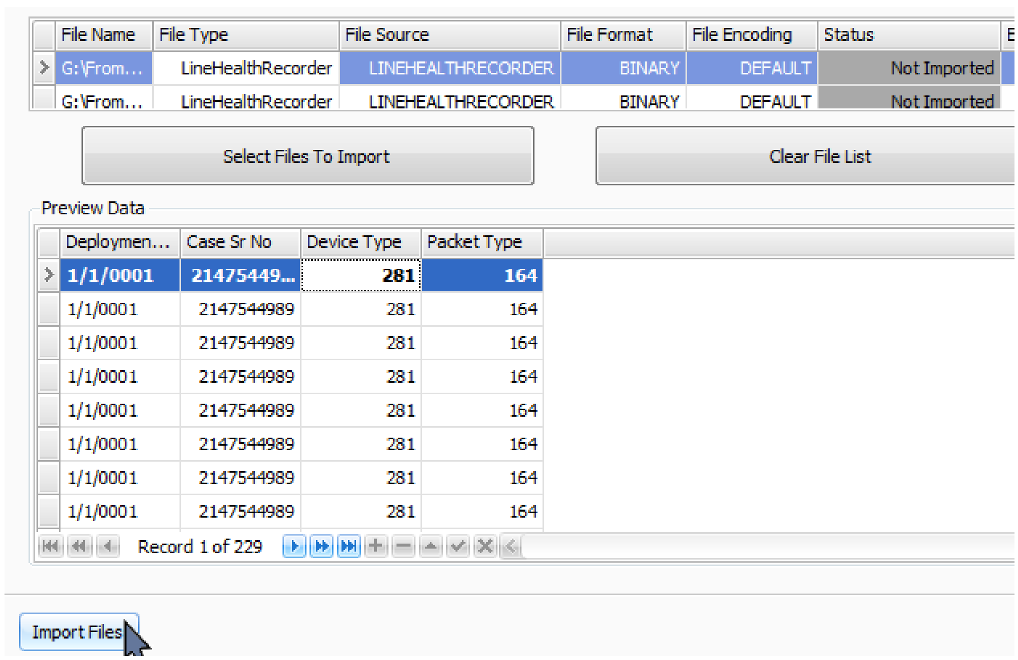


If you do not apply any rules, you will need to select one file at a time:

In the Import External Logs windows click the **Select Files To Import** button.



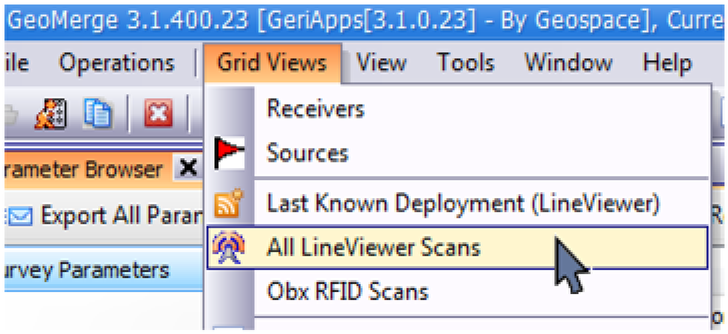
Select the binary files provided by the LHR. More than one file can be selected. Click the **Import Files** button.



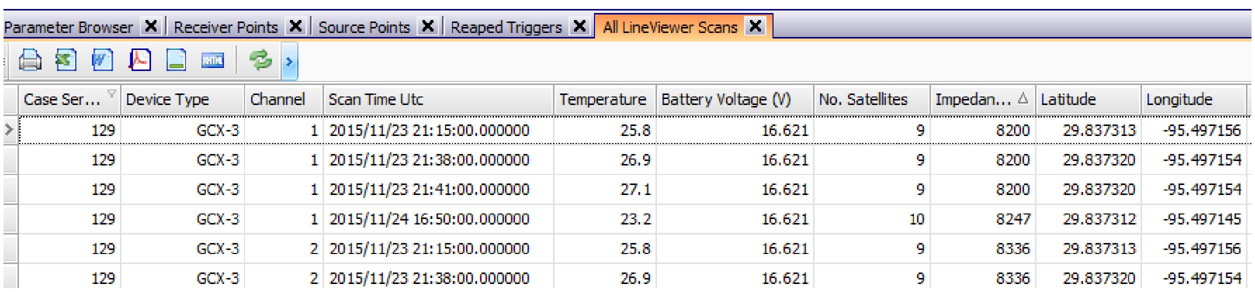
After the software reports an **Imported successfully** status, click **Next** and then **Finish**.

4.3 – Evaluating status provided by LHR files

Click on **Grid Views > All LineViewer Scans** to see the status from all recording devices:

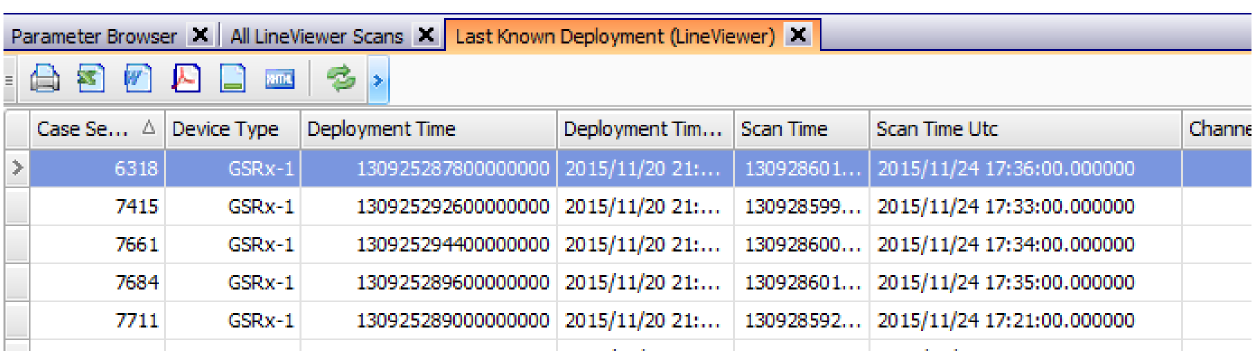


This view has all reported statuses. If the recording devices remained in communication with the LHR for several minutes, a new line is created in this view for each minute.



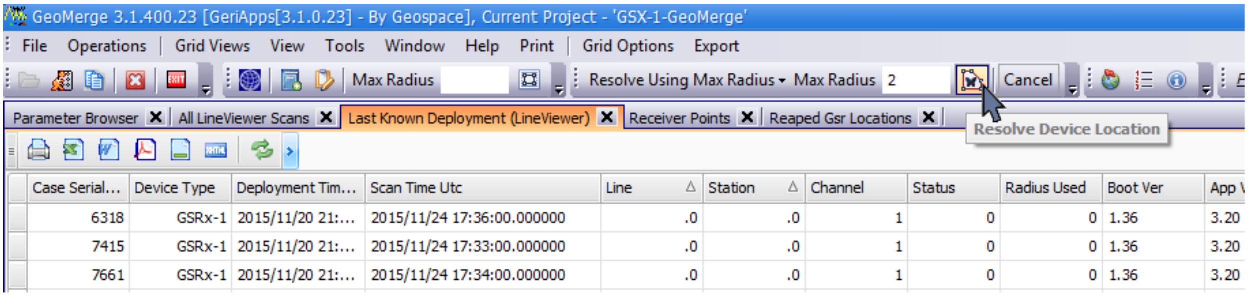
Case Ser…	Device Type	Channel	Scan Time Utc	Temperature	Battery Voltage (V)	No. Satellites	Impedan…	Latitude	Longitude
129	GCX-3	1	2015/11/23 21:15:00.000000	25.8	16.621	9	8200	29.837313	-95.497156
129	GCX-3	1	2015/11/23 21:38:00.000000	26.9	16.621	9	8200	29.837320	-95.497154
129	GCX-3	1	2015/11/23 21:41:00.000000	27.1	16.621	9	8200	29.837320	-95.497154
129	GCX-3	1	2015/11/24 16:50:00.000000	23.2	16.621	10	8247	29.837312	-95.497145
129	GCX-3	2	2015/11/23 21:15:00.000000	25.8	16.621	9	8336	29.837313	-95.497156
129	GCX-3	2	2015/11/23 21:38:00.000000	26.9	16.621	9	8336	29.837320	-95.497154

The other option is to use **Grid Views > Last Known Deployment (Line Viewer)** to see only the last reported status from the recording device.



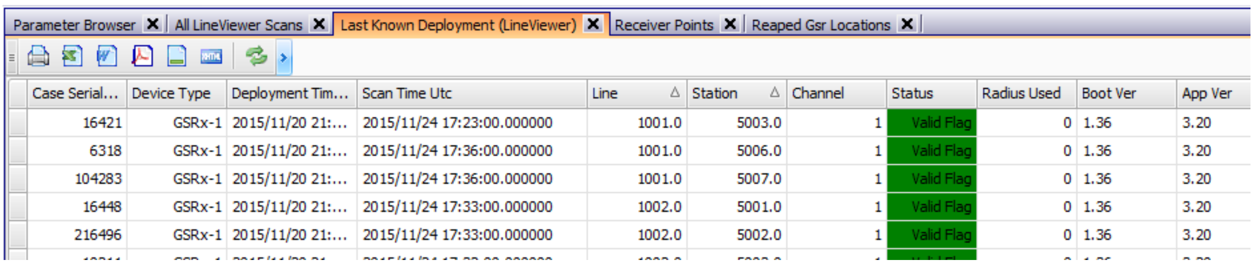
Case Se…	Device Type	Deployment Time	Deployment Tim…	Scan Time	Scan Time Utc	Channe
6318	GSRx-1	130925287800000000	2015/11/20 21:…	130928601…	2015/11/24 17:36:00.000000	
7415	GSRx-1	130925292600000000	2015/11/20 21:…	130928599…	2015/11/24 17:33:00.000000	
7661	GSRx-1	130925294400000000	2015/11/20 21:…	130928600…	2015/11/24 17:34:00.000000	
7684	GSRx-1	130925289600000000	2015/11/20 21:…	130928601…	2015/11/24 17:35:00.000000	
7711	GSRx-1	130925289000000000	2015/11/20 21:…	130928592…	2015/11/24 17:21:00.000000	

Recording devices do not have any line and station number. To associate recording devices to their respective receiver points, they must to be resolved. To resolve all devices, enter a **Max Radius** value and click the **Resolve Device Location** icon:



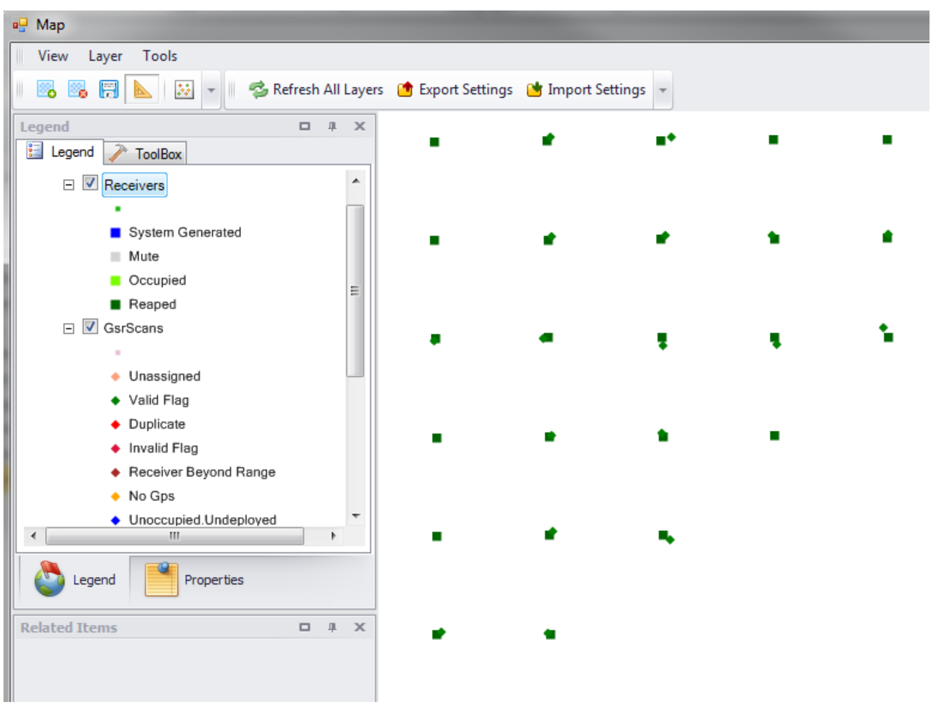
Case Serial...	Device Type	Deployment Tim...	Scan Time Utc	Line	Station	Channel	Status	Radius Used	Boot Ver	App V
6318	GSRx-1	2015/11/20 21:...	2015/11/24 17:36:00.000000	.0	.0	1	0	0	1.36	3.20
7415	GSRx-1	2015/11/20 21:...	2015/11/24 17:33:00.000000	.0	.0	1	0	0	1.36	3.20
7661	GSRx-1	2015/11/20 21:...	2015/11/24 17:34:00.000000	.0	.0	1	0	0	1.36	3.20

After recording devices have been resolved, you can see the receiver point association and a valid flag status:



Case Serial...	Device Type	Deployment Tim...	Scan Time Utc	Line	Station	Channel	Status	Radius Used	Boot Ver	App Ver
16421	GSRx-1	2015/11/20 21:...	2015/11/24 17:23:00.000000	1001.0	5003.0	1	Valid Flag	0	1.36	3.20
6318	GSRx-1	2015/11/20 21:...	2015/11/24 17:36:00.000000	1001.0	5006.0	1	Valid Flag	0	1.36	3.20
104283	GSRx-1	2015/11/20 21:...	2015/11/24 17:36:00.000000	1001.0	5007.0	1	Valid Flag	0	1.36	3.20
16448	GSRx-1	2015/11/20 21:...	2015/11/24 17:33:00.000000	1002.0	5001.0	1	Valid Flag	0	1.36	3.20
216496	GSRx-1	2015/11/20 21:...	2015/11/24 17:33:00.000000	1002.0	5002.0	1	Valid Flag	0	1.36	3.20

Recording device positions reported from the LHR can also be evaluated in the map view.



Quick status information includes:

- **Case Serial Number:** Scanned device serial number.
- **Device Type:** Code corresponding to the type of device used for acquisition; it will be associated to the proper device type (GSR, GSX, etc.) after import.
- **Num. Active Channels:** Displays the number of active channels used and expected to be output in a multichannel device.
- **Channel**: Device's channel number.
- **Line:** Status from devices sent to the LHR do not include line-station association; the association to a receiver line is implemented in GeoMerge after devices are resolved.
- **Station:** Status from devices sent to the LHR do not include line-station association; the association to a receiver station is implemented in GeoMerge after devices are resolved.
- **Deployment Time:** Numeric UTC time when the device was deployed.
- **Deployment Time Utc:** UTC date and time when the device was deployed.
- **Scan Time:** Numeric UTC time when the device was scanned.
- **Scan Time Utc:** UTC date and time when the device was scanned.
- **Boot Version:** Boot firmware version loaded in the device.
- **APP Version:** Application version loaded in the device.
- **FPGA Version:** FPGA version loaded in the device.
- **Latitude:** Last Latitude position acquired by device at the time it was scanned by LHR.
- **Longitude:** Last Longitude position acquired by device at the time it was scanned by LHR.
- **Altitude:** Not available for LHRs.
- **X:** Easting calculated from position read by recording devices and geodetics.
- **Y:** Northing calculated from position read by recording devices and geodetics.
- **Z:** Not available for LHRs.
- **Radius Used:** Valid for LineViewers only (location radius parameter).
- **Flash Capacity (MB):** Not available for LHRs.
- **Available Data (MB):** Data available in the recording device since the last time device was cleared, at the time it was scanned by the LHR.

- **Hours Until Full:** Hours remaining until memory gets full. This calculation includes memory capacity and working hours.
- **Temperature:** Shows the device temperature (Celsius) at the time it was scanned by LHR.
- **GPS Mode:** Not available for LHRs.
- **Max Phase Error (µsec):** Not available for LHRs.
- **No. Satellites:** Number of satellites locked by the device at the time device was scanned.
- **Battery Serial Number:** Serial number of the battery connected to the device. Batteries without electronics inside show serial number zero (0).
- **Battery Type:** Battery type connected to the device. Batteries without electronics inside are marked as lead acid.
- **Battery Label:** Shows the part number and description of the battery connected to the recording device at the time it was scanned**.**
- **Battery Capacity:** Battery capacity in Amps-Hours.
- **Battery Voltage:** Voltage measured in the battery at the time device was scanned.
- **Battery Percent Remaining:** Not applicable for LHRs.
- **Battery Days Remaining:** Not applicable for LHRs.
- **Battery Forecast Confidence:** Not applicable for LHRs.
- **Test Mode:** Not applicable for LHRs.
- **Impedance (Ohms):** Last sensor **Impedance** test result processed by the device at the time device was scanned.
- **RMS Noise (µVolts):** Last input value reported by the device at time device was scanned.
- **CMRR (dB):** Last sensor **Common Mode Rejection Rate** test result processed by the device at the time device was scanned.
- **Xfeed (dB):** Last sensor **Xfeed** test result processed by the device at the time device was scanned.
- **THD (%):** Last sensor **Total Harmonic Distortion** test result processed by the device at the time device was scanned.
- **LineViewer Name:** Serial number of the LHR.
- **Flag Originator:** Shows the source of the flag association, Options are:
    - **LV user:** Does not apply for LHR.
    - **LineViewer:** Does not apply for LHR.

- **Central System**: When it is associated after resolving the units.
- **Central User:** Manually set by GeoMerge User.
- **Unknown:** When association has not been established.

- **Condition Flags:** Reflects status of the device. Options are:
  - **GPS On:** GPS circuitry was turned on at the time device was scanned.
  - **GPS Off:** GPS circuitry was turned off at the time device was scanned; this could reflect a normal condition when using cycle mode.
  - **Recording:** Unit was recording data at the time device was scanned.
  - **Sleeping:** Recording device was in sleeping mode at the time device was scanned.
  - **RT Clock Not Set:** Real time clock was not set at the time device was scanned.
  - **Memory Low:** Device's memory was about to be full when device was scanned.
  - **No Leap Seconds:** Recording device had not evaluated the leap second at the time device was scanned.
  - **GPS Not Locking:** Recording device had not locked to GPS at the time device was scanned.
- **Error Flags:** Shows any error condition detected by the device at the time it was scanned.
- **Scan Contents:** Shows **Quick Status** for LHR.
- **Status:** After stations are resolved, this column shows status about association with line-station:
  - **Valid flag:** The device is located inside the associated receiver point radius.
  - **Invalid flag:** Scanned device has an invalid receiver point assignment.
  - **Duplicate**: Scanned device has a receiver point assignment identical to another device.
  - **Receiver Point Beyond Range:** Scanned device reported a position beyond range (more than 50 meters from projected receiver point).
  - **Unassigned:** Scanned device has not been assigned to a receiver point.
  - **No GPS:** Scanned device did not report a valid GPS position to the LHR.
  - **Undeployed:** Receiver point is not currently associated with any device.