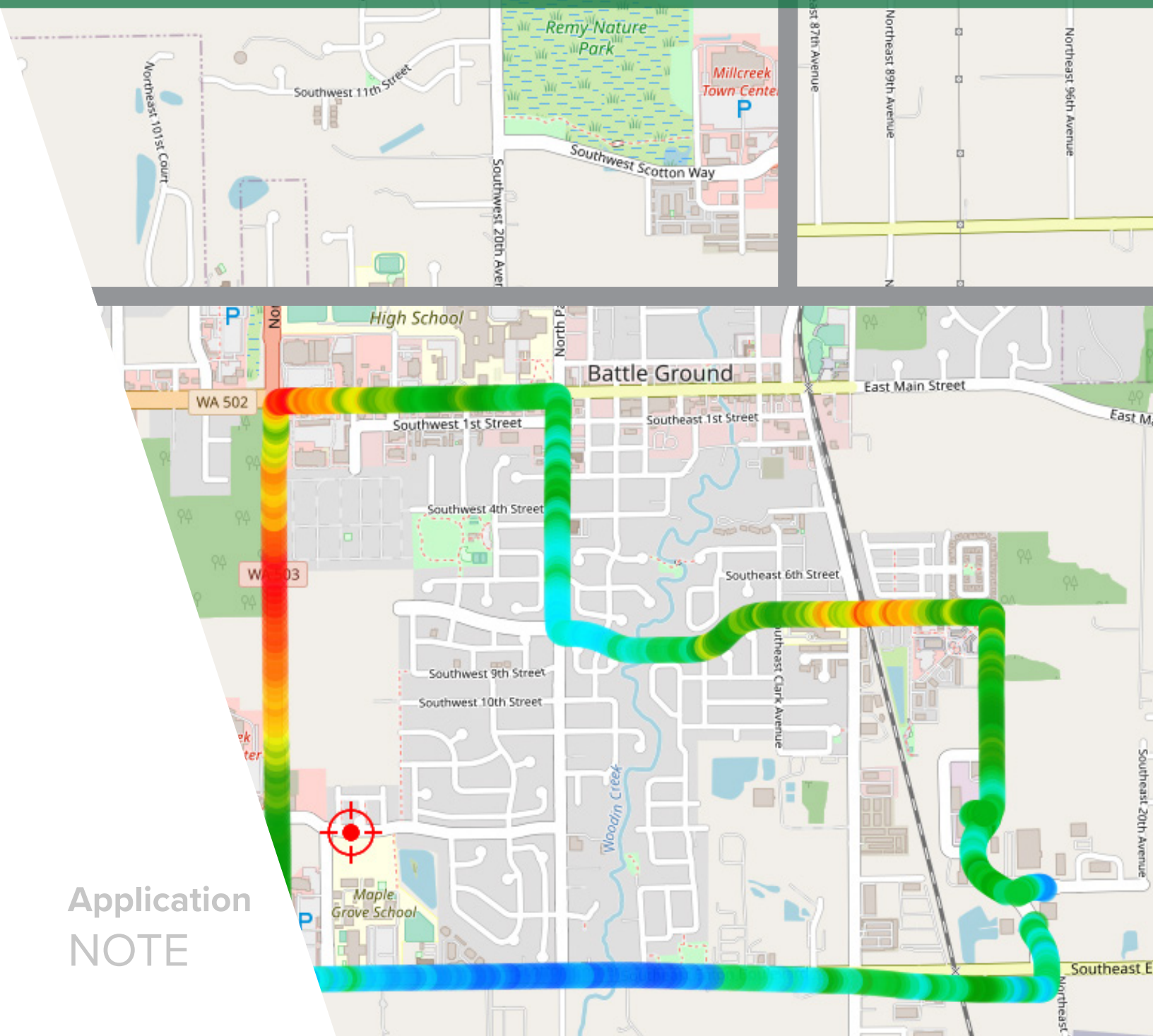


RF Mapping Drive Test Walk-Through With Mapping Analysis Mode in Spike Analyzer Software

By Roger Rush, Signal Hound – November 30, 2021



Application
NOTE

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Introduction

Location is a critical dimension of spectrum analysis in the field. Whether testing network coverage or modeling wireless performance on outdoor installations and indoor DAS systems, a geospatial data layer provides necessary context for RF measurements.

Spike's new RF mapping analysis mode provides the tools for efficiently conducting RF measurements bound to a geographical location with results displayed on a map, and packs features designed for convenience. Measurements are heat-mapped based on an adjustable color or grayscale spectrum, and can be directional for triangulation of an energy source. Audio Received Signal Strength Indicator (RSSI) aides in intuitive eyes-free operation.

GPS integration enables automatic measurements based on location and time. For indoor use cases, an image such as a floorplan can be loaded in the map view, and measurements taken manually by clicking on the image, with measurement points anchored only by their position on the image.

Overview

This document walks through the steps in detail of performing a drive test using the RF mapping features of the Spike spectrum analyzer software. We will be testing coverage of a nearby cellular tower.

Requirements

- A Signal Hound spectrum analyzer.
- A laptop meeting the standards specified in the System Requirements section of the [Spike User Manual](#), with the [Spike](#) software installed.
- An external GPS unit connected to the computer or a Signal Hound SM series device (which also has an internal GPS). For information on GPS setup, see the GPS section of the [Spike User Manual](#).
- An antenna connected to the RF input of the spectrum analyzer.

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Setup

Before beginning the drive test, we will set up our map and measurement configuration.

Creating a Map

For a more detailed version of this process, see the **OSM Map Import Guide for Mapping Mode in Spike**, found in the Spike application directory.

Downloading Map from OpenStreetMap

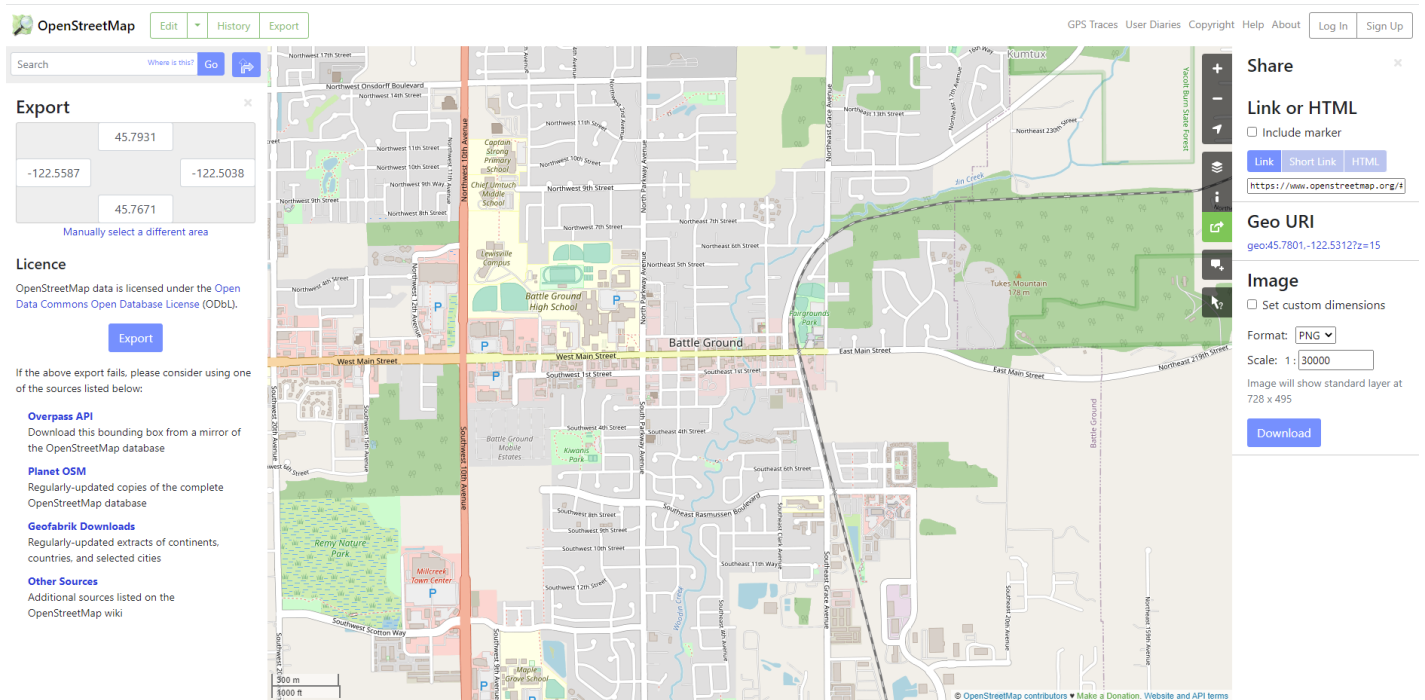


Figure 1: An OSM map with Export and Share panels visible, and the image's bounding coordinates shown in the Export panel.

1. In a web browser, navigate to <https://www.openstreetmap.org/>.
2. Using the map controls, configure the map to show the desired region for the drive test. Having a little extra will help avoid running out of map space while in the field.
3. Click the Export button in the upper left navigation bar to reveal the Export panel.
4. Click the share icon in the upper right vertical toolbar to reveal the Share panel.
5. Set the scale to a size that will fit comfortably on screen within the map view area in Spike.
6. Download the map by clicking the blue Download button in the Share panel.

Loading Map in Spike

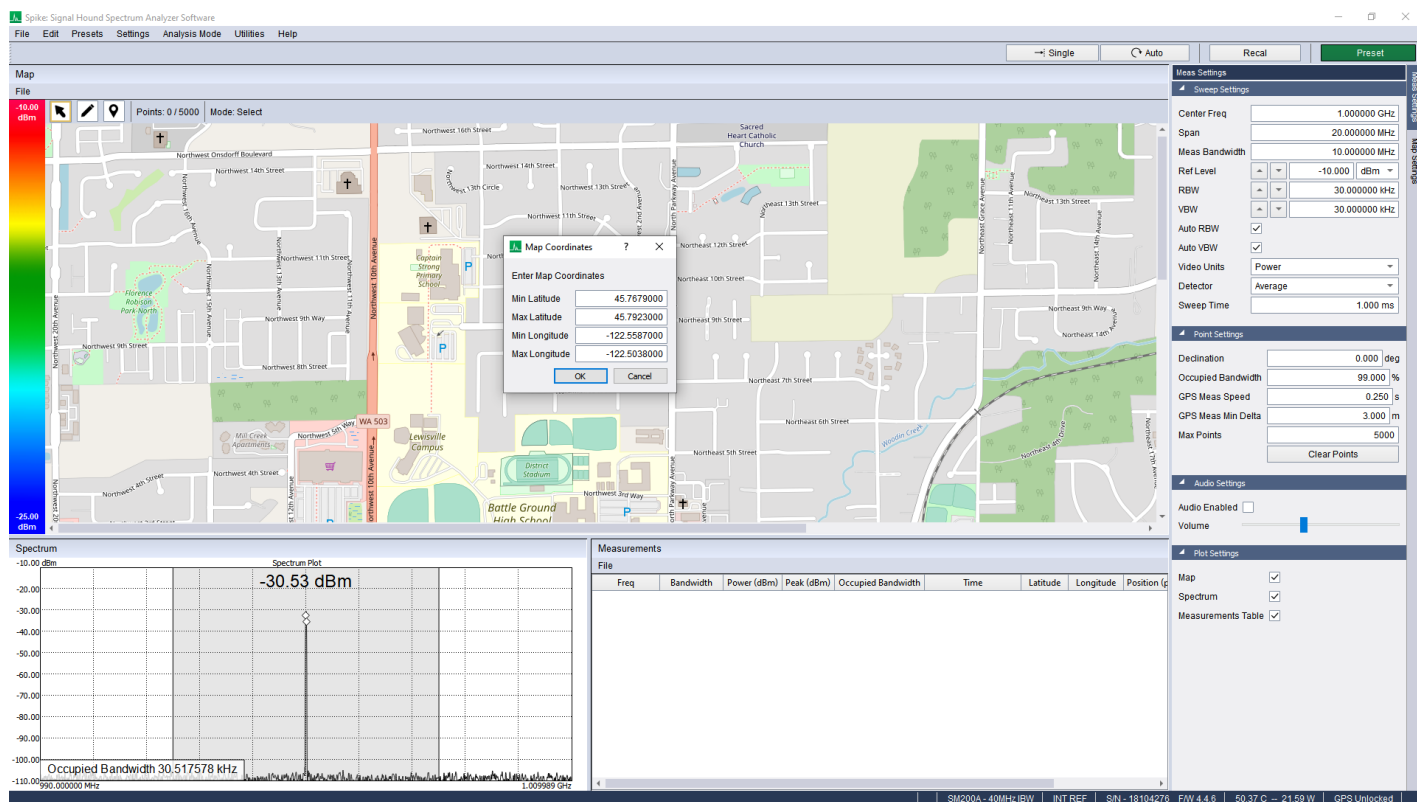


Figure 2: Setting the reference coordinates of a map loaded in Spike.

1. In Spike, click *Analysis Mode > Mapping* to open the mapping software.
2. In the map view area, click *File > Load Map*, and select the image downloaded from OpenStreetMap.
3. Click *File > Set Coordinates* and enter the bounding georeferencing latitude and longitude coordinates of the image, as displayed in the Export panel on the OSM website. This will georeference the map, allowing measurements to be accurately placed using the coordinates provided from the GPS.
4. It is a good idea to verify the map's accuracy. In Spike, click the pencil icon in the map view toolbar to enter "Click mode". Click somewhere on the map to add a point. On the map on the OSM website, right click in the same place and select "Show address". The latitude and longitude coordinates shown should be very close to those shown in the map detail pane in Spike.

Configuring the Measurement

Note: this can be done on a different PC from the one that will go out in the field.

Configure a sweep using the parameters in the *Sweep Settings* section of the *Meas Settings* control panel on the right in Spike. For this demonstration we are interested in an LTE signal centered at 751 MHz from a nearby cell tower. We set the meas bandwidth to 10 MHz, and a fairly high ref level to avoid overloading the device when the signal gets hot.

Under *Point Settings*, the *GPS Meas Speed* and *GPS Meas Min Delta* fields define the minimum time and distance between measurement points. While driving in GPS mode, a new measurement will be captured only when at least the minimum time has elapsed since and the minimum distance travelled from the last measurement taken.

In the *Map Settings* control panel, adjust the *Map Scale* and *Point Size* if needed.

Saving the Session

In RF mapping mode in Spike, a session contains all the information needed to reconstruct the current scenario: measurements taken, measurement and map configuration settings, map image, and map georeferencing coordinates.

Having self-contained sessions allows for easy recall of a common configuration or a field test, as well as easy transfer between different PCs running Spike. For instance, a session could be configured in the lab and transferred to a field PC; then every time the field PC runs a test, it opens that session, takes measurements, and saves the result as a new session, which is transferred to the lab PC for analysis.

On the hard disk, a session is represented by three files: the image file, a .spikemap file, and an .ini file. If moving the session to another PC, make sure to move all three files.

Save and open the session by clicking *File > Export Session* and *File > Import Session* in the map view's menu bar.

Equipment & Vehicle Preparation



Figure 3: An external GPS unit on roof of vehicle, next to antenna.

Ideally, the GPS receiver and RF antenna should be mounted to the roof of the car. If this is not possible, they can reside inside the car, as exposed to the outside as possible.



Figure 4: A BB60C spectrum analyzer with antenna, connected to a laptop running Spike's RF mapping software in vehicle.

The laptop can be mounted on the dashboard, rested on the passenger seat, or held and operated by a passenger.

It does not matter where the Signal Hound spectrum analyzer is. Make sure all the connections are secure and will not come unplugged due to vehicle movement.

GPS Setup

Configure your GPS using *Utilities > GPS Control Panel*, referring to the GPS section of the [Spike User Manual](#) as needed. You may need to adjust the GPS Type, COM port number, and baud rate, both in Spike and in the Windows Device Manager and/or your GPS unit's configuration software. Clicking the *Connect* button will begin the connection process. It can sometimes take up to 10 minutes for the GPS to sync, especially if it has not connected to the computer before.

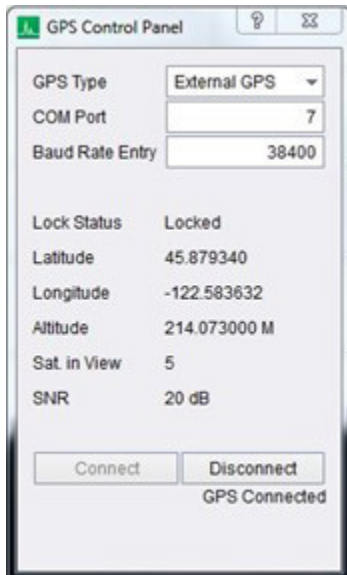


Figure 5: GPS Control Panel in Spike.

If the GPS is synced (and assuming the map is properly georeferenced), then a red target will indicate your current position on the map.

Note: If you are using an SM series device, the GPS status is displayed at the far right of the bottom toolbar in Spike.

Drive Test

1. Before driving, turn on the laptop, open Spike, and load the session if needed by clicking *File > Import Session* from the map view's menu bar.
2. Verify that a signal is present and looks as expected in the spectrum plot. Verify that the GPS is synced, and your location is shown as a red target on the map.
3. When ready, activate "GPS Mode" by clicking the GPS paddle icon in the map view toolbar. The first measurement will be taken, and measurements will continue to be taken automatically whenever the specified time and distance have been reached from the last measurement.

If desired, turn on the audio RSSI by clicking the *Audio Enabled* checkbox in the *Audio Settings* section of the *Meas Settings* control panel, and adjust the volume. Now a tone will be continuously output from the PC whose frequency reflects the power of the signal, with higher frequencies corresponding to higher channel power readings.

4. At this point, we can start driving around the area of interest, while measurements are automatically taken. To get measurements at the default 3 meters and 250 ms apart, we need to drive at most 27 mph (43 km/h).
5. When the area has been sufficiently surveyed, enable "Click Mode" or "Select Mode" to disable the automatic GPS measurement. In select mode (the arrow icon in the map view tool bar), when you click a point, its details will be shown in a pane on the left.
6. From there, the session can be exported which will save the full configuration and all measurements taken. It can then be imported for later analysis, on any PC running Spike. For details, see *Saving the Session*.

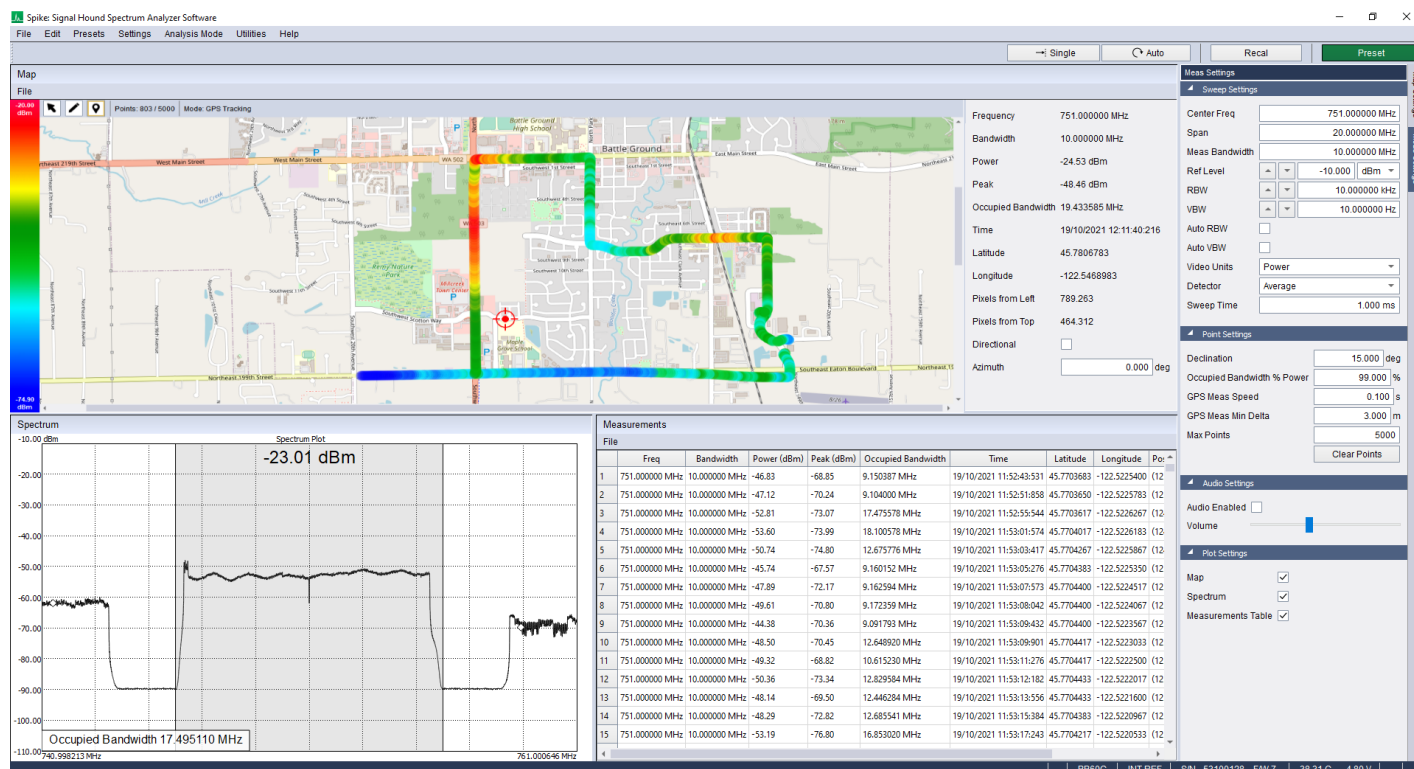


Figure 6: Spike RF mapping session showing cell tower coverage testing using BB60C.

Exporting the Measurements

Measurement point data can be saved in CSV or KML format by selecting the respective option in the *File* menu of the Measurements Table menu bar.

KML files can in turn be opened in Google Earth™ mapping service, with full heat mapping preserved, Google Maps™ mapping service, and other compatible programs.

Conclusion

This is one example of how Spike's RF mapping software might be used. The process expounded here can be applied in a variety of contexts, using different maps, and testing for different kinds of signals.

As with all Signal Hound software, RF mapping is available for free in the [Spike software](#).

Hardware & Software

- [Signal Hound spectrum analyzers](#)
- [Spike software](#)

Further References

For more information on RF mapping in Spike spectrum analyzer software with Signal Hound spectrum analyzers, please consult the following resources:

- [Spike User Manual, Section: Mapping Mode](#)
- [OSM Map Import Guide for Mapping Mode in Spike](#) (found in the Spike application directory under manuals)

About Signal Hound

Signal Hound designs and builds powerful, affordable spectrum analyzers and signal generators for engineers and RF professionals around the globe. Whether you're needing EMC precompliance capabilities in a small two-person shop or spectrum monitoring on a national scale, our test equipment is designed with you in mind. Accurate and powerful enough for mission-critical RF analysis, priced at a point accessible to most, and supported by a talented group of engineers committed to what they do – we truly believe that our devices offer unrivaled value in the test equipment industry.

In business since 1996 and selling our own line of Signal Hound test equipment since 2010, we've built the foundation of our company on years of test equipment repair, service, hardware and software development, and manufacturing experience. Signal Hound is a small company with big goals – and an even bigger commitment to providing our customers with an outstanding experience when purchasing and using our products.

