Interference Location Mapping

With the Anritsu E-Series and C-Series Spectrum Master™, Cell Master™, and Site Master™ with Option 25, Interference Analyzer

Introduction

Spectrum analyzers provide accurate RF power measurements over a wide frequency range. With a directional antenna and the on-screen map display with Option 25, Interference Analyzer, the location of transmitted signals can be identified and documented on the display of the analyzer.

The Anritsu E-Series and C-Series Spectrum Master, Cell Master, and Site Master models with spectrum analysis capability can include Option 25 Interference Analysis. This option supports on-screen GPS map displays with indication of current location and direction to an interference signal.

In this application note, you will learn how to fully operate the instrument with accordance to the Interference mapping process. Interference Location Mapping requires Option 31, GPS. The GPS receiver will automatically pinpoint your location relative to the on-screen map and the user can indicate on the map the direction to a signal transmitter. The intersection from multiple GPS locations can indicate the source of the interference.

Anritsu Map Master

Note: A USB flash drive is required to transfer MAP (.map) files to the instrument.

To view maps with GPS, a PC software program called “Map Master” must be used in order to convert picture files captured from a map provider to a MAP (.map) file for the instrument to read. Map Master is located on the CD provided with the instrument, or can be downloaded and installed from the Anritsu website (www.anritsu.com). The ideal image size would be close to 666 pixels x 420 pixels (~1.6:1 ratio).

The first step is to create a MAP file using Map Master.

Map Master has the capability to capture a map directly from the source to the program. To do so, press **Capture Map**. The software program will load a 3rd party map provider, and you can enter the address of the area you wish to map. There is a zoom option as well, so the map and area can be larger or smaller. Once the proper specifications are made, press **Capture Map** located at the lower right. The picture is now on the Map Master screen and the latitudinal and longitudinal coordinates have been entered. Then press **File | Save As** to save as a MAP file. Set the destination to the USB flash drive, which can then be inserted into the instrument.

Create Map file using Map Master

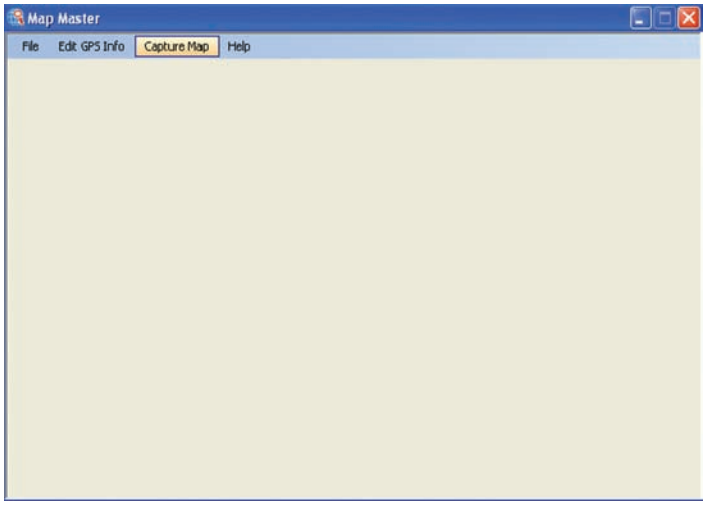

Figure 1: Capturing the Map

After pressing **Capture Map**, Map Master will load a 3rd party map provider for easy screen-capturing.

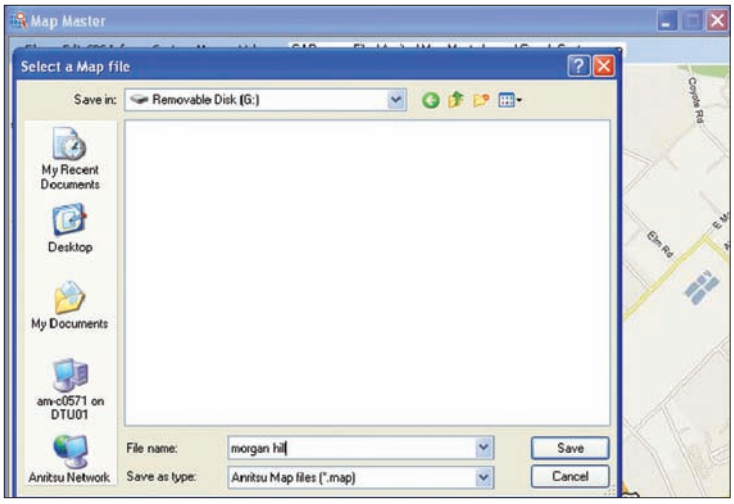

Figure 2: Saving the Map

After pressing **Capture Map** on the bottom right, the map and coordinates will be sent to Map Master. Once done, simply save it to the USB flash drive.

Getting Started

Prior to conducting the interference mapping survey, the analyzer itself must first be configured to properly measure the signals of interest. Knowledge of various parametrics such as anticipated signal strength and variation, potential presence of interfering signals, and noise sources should be used in determining analyzer settings. A brief summary of the main analyzer setups is shown below. However, the user may want to refer to the instrument user manual for more detailed guidance.

1. Bandwidth Parameters
    a. Resolution Bandwidth (RBW): minimum bandwidth over which one can separate two signals for viewing. The RBW can be decreased for viewing closely spaced signals at the expense of acquisition time. A low RBW is also advantageous in limiting noise distortion and resolution of low-level signals.
    b. Video Bandwidth (VBW): used for averaging and filtering noise. This is particularly useful in discerning low-level signals in the presence of noise.
2. Reference Level, Pre-Amplifier and Attenuator
    a. Reference Level: Input signal levels are reference to the top line of the graticule, known as the reference level. Depending on the amount of power anticipated in the signals to be measured, the reference level should be adjusted accordingly.
    b. Pre-Amplifier and Attenuator: In order to present the proper signal level to the analyzer detection circuits, pre-amplification or attenuation can be adjusted on the signal input. The attenuator can be automatically adjusted as a function of the reference level. In general, signals below -40 dBm can use the pre-amplifier while signals over -30 dBm should be attenuated. For example, if the reference level setting is 20dBm, attenuation should be set to 50dB for a mixer input of -30 dBm.
3. Detector Type
    a. Various detection circuits can be utilized. These include Peak, RMS, Negative and Sample. The type of detection is predicated on the user's measurement needs.
4. Filtering
    a. Filtering should be used to measure signals in the presence of interferers. Filters can be added to the input of the analyzer to discriminate between wanted and unwanted signals, avoiding corruption of the measurement with adjacent high level signals.
5. Frequency
    a. Select frequency to be measured.

Interference Mapping Mode

In order to Interference Map, the instrument must be in both the Interference Analyzer and Interference Mapping mode.

1. Access the Main Menu by pressing the **Menu** key on the keypad.
2. Press the **Interference Analyzer** soft key icon.
3. Press the **Measurements** soft key to load up the Measurements submenu. (Figure 5)
4. In the new submenu, press soft key **Interference Mapping**. (Figure 5)
5. The instrument then turns on Interference Mapping, and by pressing **Interference Mapping** once again, you enter the Interference Mapping menu. (Figure 6)

An alternative method would be through the keypad function of Shift + Mode (9).

1. Press the **Shift + Mode (9)** key.
2. In the pop-up menu, scroll down until **Interference Analyzer** is selected. (Figure 4)
3. Press **Enter** on the keypad. The instrument then opens the Measurements submenu. (Figure 5)
4. In the new submenu, press soft key **Interference Mapping**. (Figure 5)
5. The instrument then turns on Interference Mapping, and by pressing **Interference Mapping** once again, you enter the Interference Mapping menu. (Figure 6)

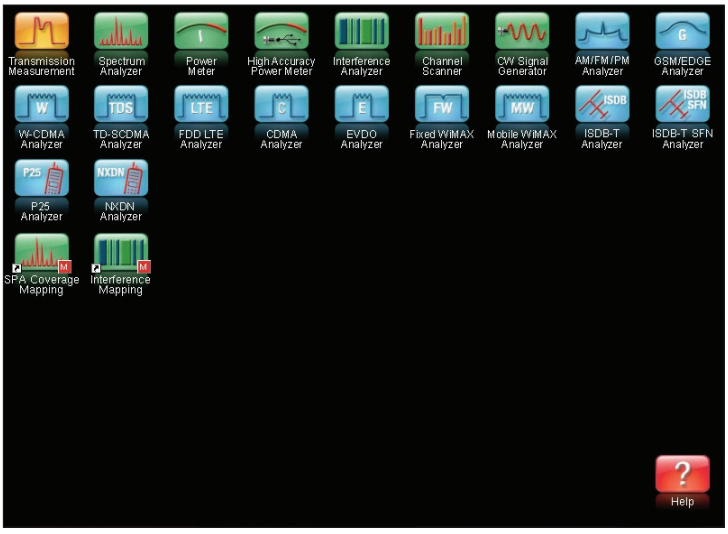

Figure 3: Entering the Interference Mode

The main menu contains the icon, **Interference Analyzer**. Pressing it enters the instrument in the interference analysis mode.

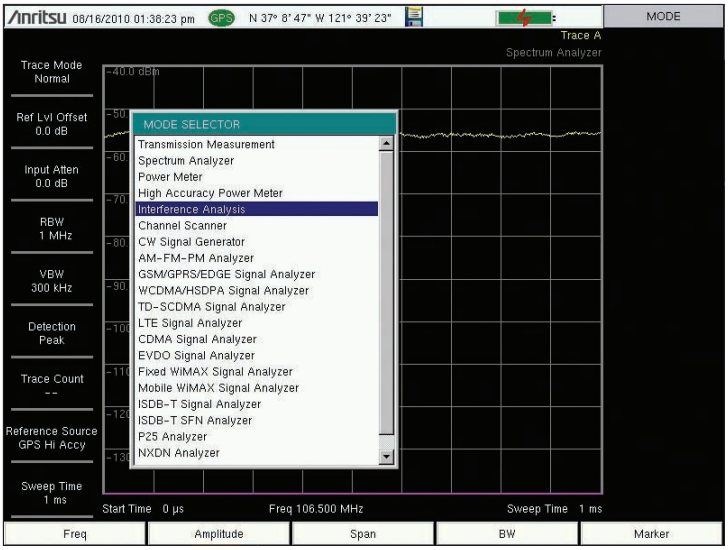

Figure 4: Mode Pop-Up Menu

Scroll down until the **Interference Analyzer** option is selected and press enter to access that menu.

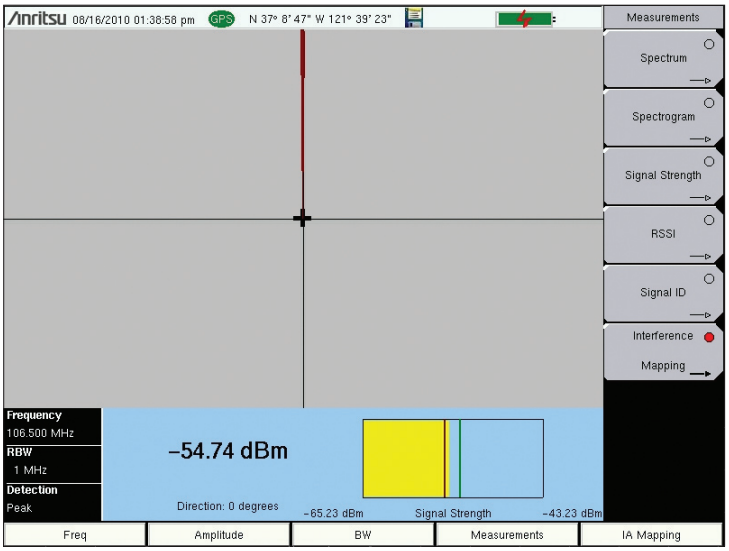

Figure 5: Measurements Menu

Once at the Measurements menu, you then press **Interference Mapping**. Once in the mode, the screen will change and the circle on the soft key will fill up with red.

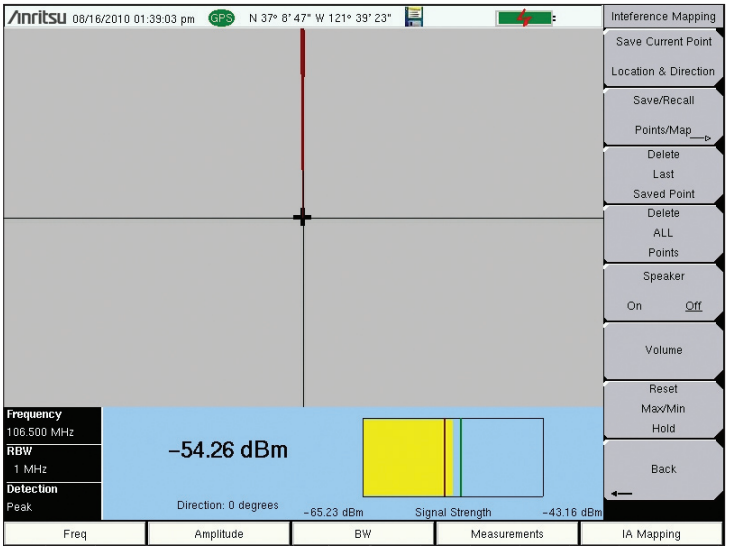

Figure 6: Interference Mapping Menu

After pressing **Interference Mapping** again, you are then directed to the Interference Mapping menu.

The simplest way to access the Interference Mapping mode would be through the main menu of the instrument. Press the touch icon **Interference Mapping**. The instrument enters both the Interference Mapping and Interference Analyzer mode. However, this does not show up on some users' screens, so in order to add this soft key, press the **Interference Mapping** button from step four, and hold for at least three seconds. There is then an option to position the soft key on the main menu.

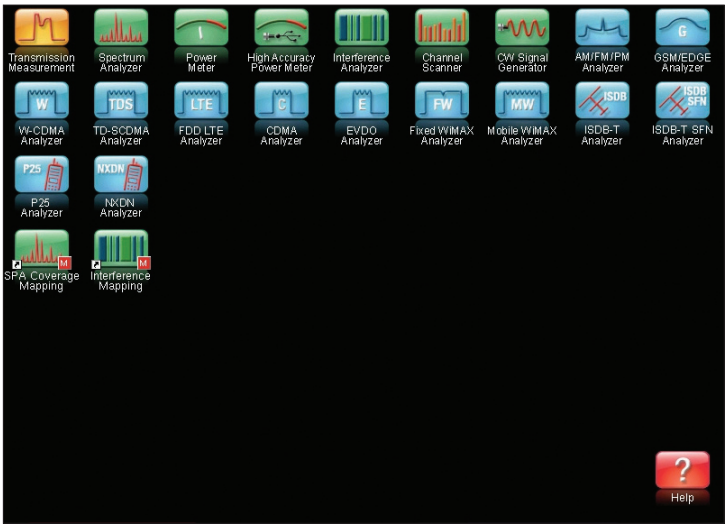

Figure 7: Interference Mapping Soft Key

The added soft key makes entering both the Interference Analyzer and Interference Mapping mode considerably more convenient.

Turning on GPS

In order to Interference Map, Option 31 (GPS), is required. To turn the GPS on, press **Shift + System (8)**, and then the **GPS** soft key. In the GPS sub-menu, you can turn the GPS on or off, view GPS info, change the GPS Voltage, or reset the GPS.

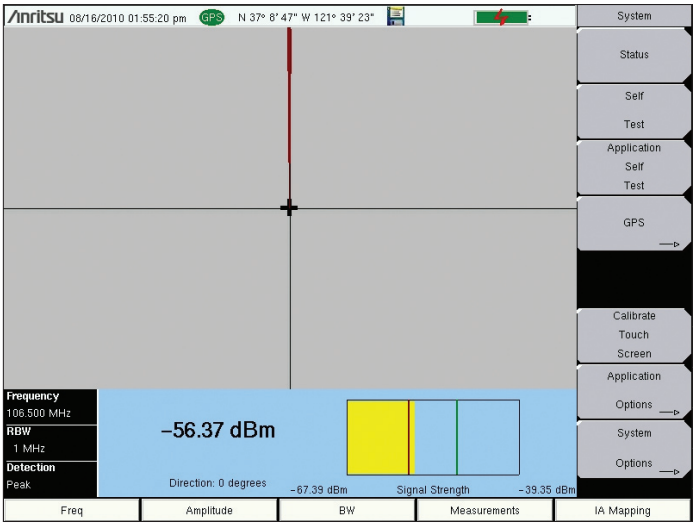

Figure 8: System Menu

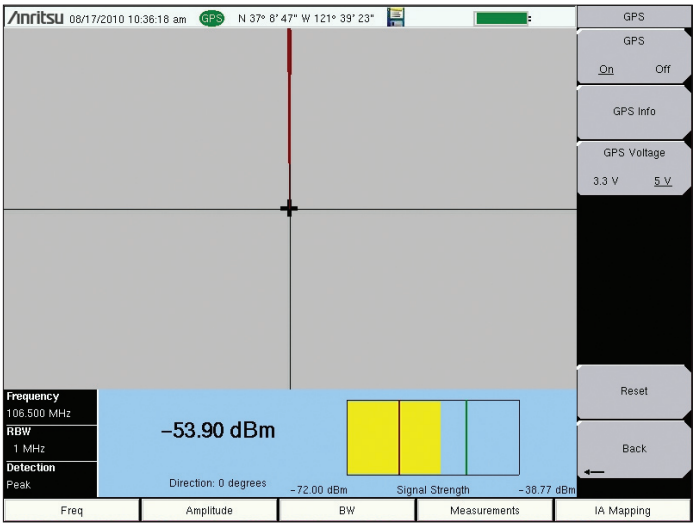

Figure 9: GPS Sub-Menu

The GPS submenu allows the user to adjust the settings and view the status of the GPS.

Interference Mapping

To begin Interference Mapping, you first must open the MAP (.map) file created earlier. Insert the USB flash drive into the USB port of the instrument. From there, press **IA Mapping**, and from that menu, touch **Save/Recall Points/Map**. In the Mapping Save/Recall submenu, touch **Recall a Map**. Find the file from the USB you inserted, and press **Enter** on the keypad. The map should now appear on the screen. If not done so already, the instrument will attempt to lock the GPS by tracking at least three satellites.

Your location will then be set for you by the instrument relative to the map. Move to the desired locations, and with a directional antenna, perform a 360 degree turn. With the sound option on, a series of beeps helps find the direction of where the signal is strongest. When the direction is found, rotate the line with the knob on the instrument relative to that position, and press **Save Current Point Location & Direction**. The instrument saves the location and direction indicated with a line of the interfering signal. Repeating the process creates multiple lines, which intersect to indicate the location of the interfering signal.

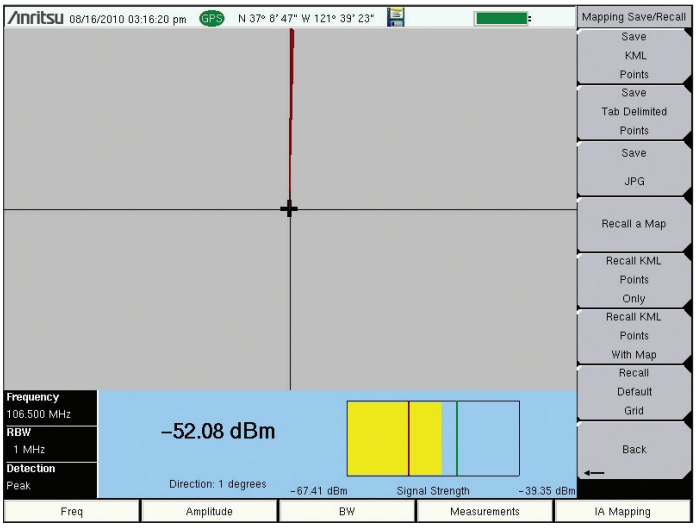

Figure 10: Recalling a Map

From the Interference Mapping menu, select **Save/Recall Points/Map** and in the next menu, **Recall a Map**.

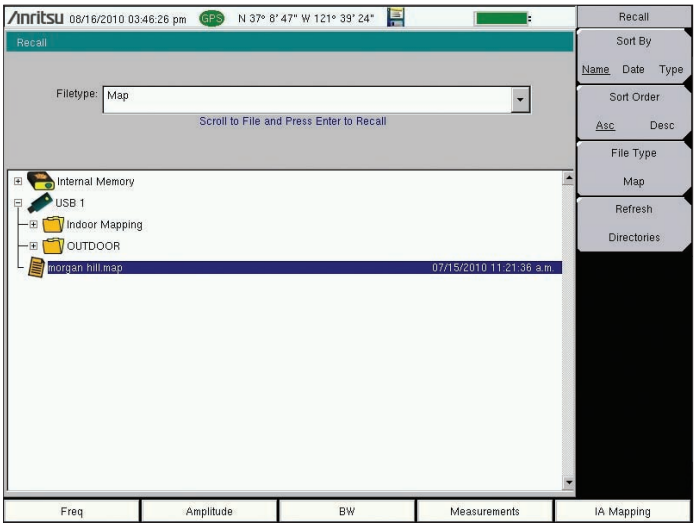

Figure 11: Selecting MAP file

Select the MAP (.map) file from the USB and press **Enter** on the keypad.

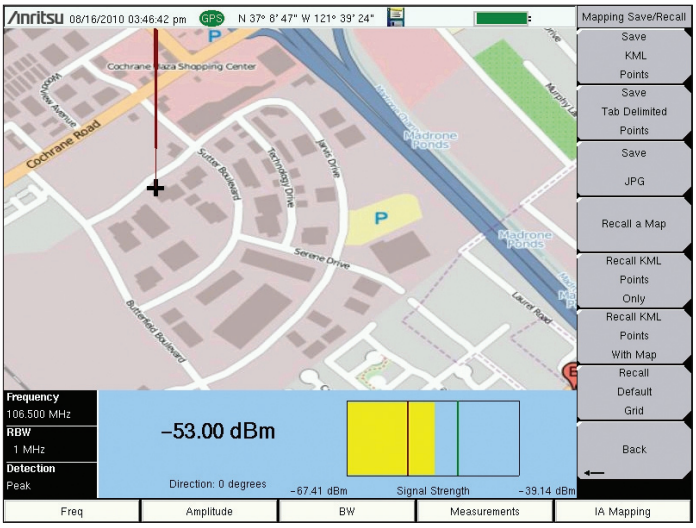

Figure 12: Position

With the map on the screen, the instrument automatically pinpoints your location relative to the map.

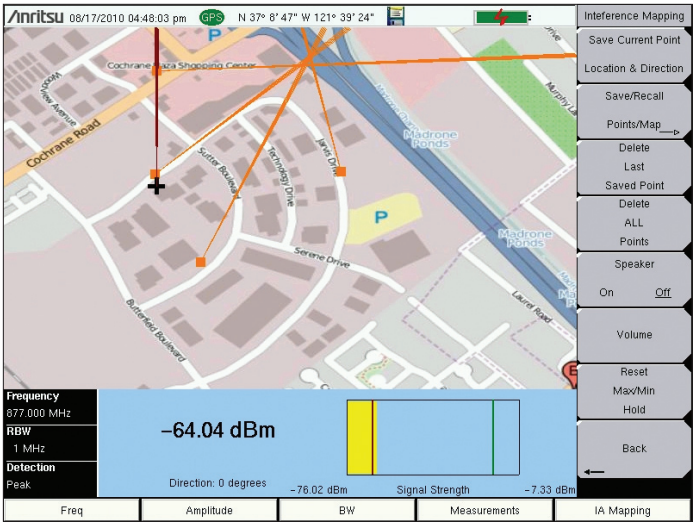

Figure 13: GPS Mapping

When you press **Save Current Point Location & Direction**, the instrument begins saves the direction and placing of the point. Multiple points create intersecting lines, and the interfering signal can be traced.

Saving the Data Collected

Once Data Collection is complete, the data points can be saved as a KML file, a tab delimited text file (.mtd), and/or a JPEG. When it is saved as a KML file, the data points can be later recalled by the instrument to be used once again and can also be opened by Google Earth. For viewing the data collected however, it is recommended that the data be saved as a tab delimited file (.mtd). A tab delimited file can be opened with notepad or Excel for easy viewing and report generation.

To begin, access the Mapping Save/Recall submenu from the Coverage Mapping Menu. From there, touch **Save KML Points**, **Save Tab Delimited Points**, or **Save JPG**. A pop-up save prompt comes up, where the filename and file type can be changed. Once finished, press enter on the keypad or touch screen to save. The file can then be copied to the USB, transferred and opened.

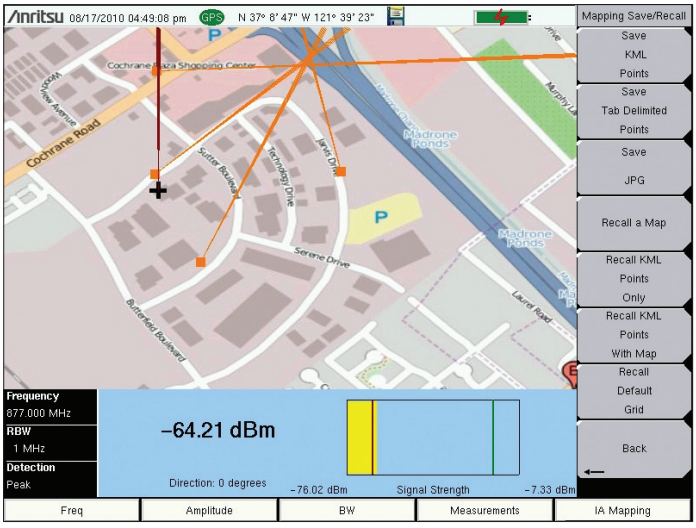

Figure 14: Saving Data Points

Access the Save/Recall Points/Map submenu from the Interference Mapping Menu.

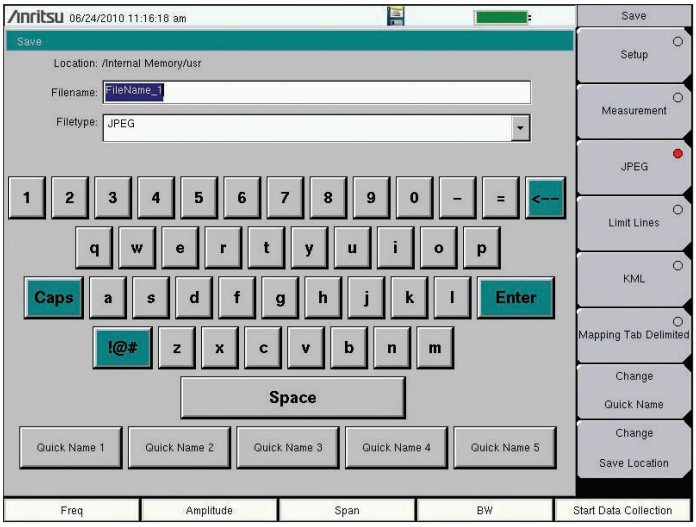

Figure 15: Saving the File

Change the needed fields, and press **Enter** in order to save the file.

Analyzing the Data

When saved as a tab delimited file (.mtd), the points recorded by the instrument can later be opened by a program such as Excel, to be viewed and analyzed.

Once opened, looking at the file from top to bottom, the first things you see are the rows 1-17. It has basic information, such as the file mode, model, serial number, and date the mapping was done. The actual data below is divided into columns.

Column A- the point number

Column B- the status of the GPS

Column C- the longitude

Column D- the latitude

Column E- the UTC date

Column F- the UTC time

Column G- the system date

Column H- the system time

Column L- the measurement strength

Column O- the bearing of the point

Column R- the configuration of the settings

Columns A-H contain the basic information concerning the interference mapping session. Columns L, O, and R have more of the analytical data derived from the instrument, so you can review and analyze the data.

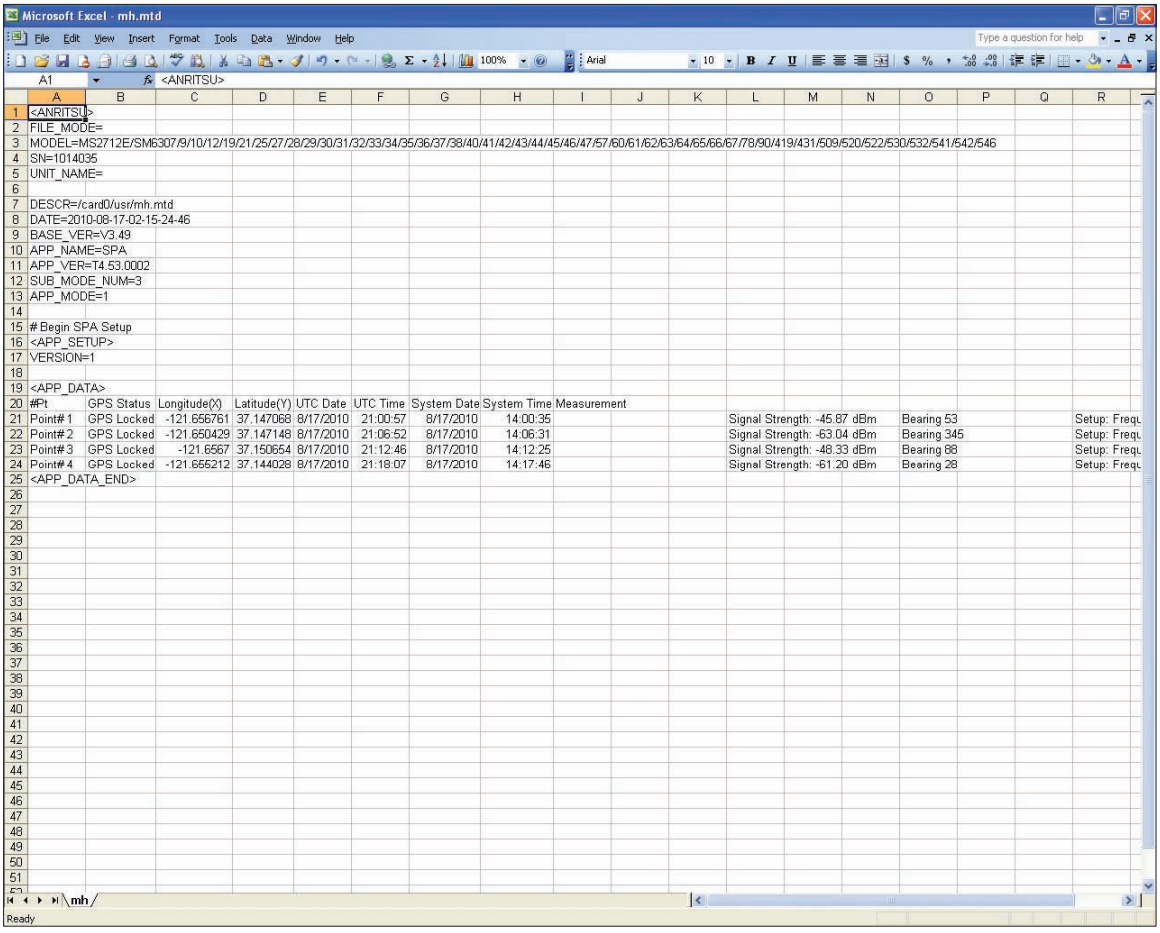

Figure 16: Viewing the Data

The data can then be opened by other software programs for analysis and report generation.

Google Earth™

Figure 17: Google Earth

With Google Earth, you can open a saved KML file transferred from the device to you computer. Simply double-click the KML file and Google Earth will run and show the points in a Digital Orthophoto Quadrangle (DOQ) format. You can also click on the points to see the more specific values given also by a tab delimited file.

To install Google Earth, go to the web site: http://earth.google.com/. Download the program and then install it to your computer. Additional help may be found through the Help pull-down menu.

Conclusion

The increasing number of wireless devices and an ever crowded spectrum is greatly increasing the problems of Interference. Wireless technicians often carry a “kit” of radios, directional antennas, and paper maps to support locating interferers.

A high performance spectrum analyzer is the most versatile receiver for interference hunting with its wide, continuous tuning range, adjustable bandwidth and wide power measurement range. Often seeing the signal on the display can help the technician identify the type of interference. With a directional antenna and the on-screen map display with the GPS location of interference signals can be documented on the display of the analyzer.

The Anritsu E-Series Spectrum Master™, Cell Master™, and Site Master™ models are powerful battery operated instruments that can support a wide range of signal types. With the addition of Option 25, Interference Analysis and the power of an integrated GPS (Option 31) and on-screen map display, interference hunters can easily mark multiple directions to an transmitter to create an intersection location point.

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