

# Five Common Field and Remote Applications

Tektronix H500/SA2500 Handheld Spectrum Analyzer

How-To Guide

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# 1. How to Build Your Own Signals with Signal Database Editor

## Overview:

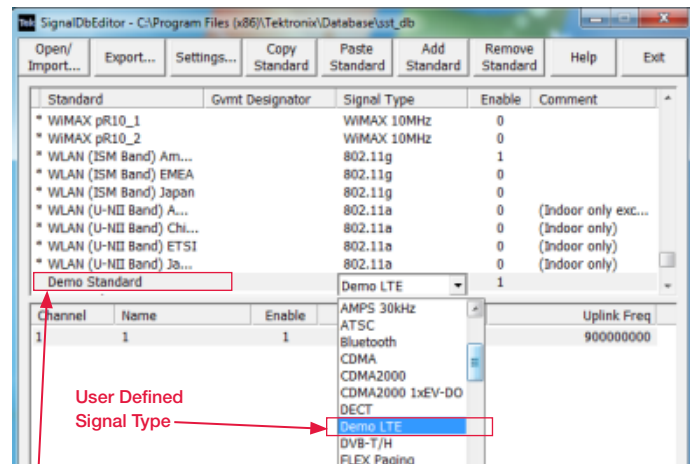
The Signal Database Editor application allows a user to define standards, channels and signal types to be used within the Tektronix H500/SA2500 Handheld Spectrum Analyzer.

You can download the free Signal Database Editor software from Tek.com:

<http://www.tek.com/spectrum-analyzer/h500-sa2500/sa2500-0-software/signal-db-editor-pc-application-installation-file-en>

This Demo guide uses 5MHz LTE Band 1 (IMT 2100) signals as an example to show how to create a new

- Signal Type
  - A group of characteristics that are common to one or more standards (such as CDMA, LTE).
- Standard
  - A group of channels with different uplink and downlink frequencies that adhere to the characteristics of a signal type (such as WCDMA 1800 DCS band, LTE 2100 AWS band).
- Spectral Profile
  - A visual profile that can be used to visually determine whether a signal as seen on the product display matches a stored profile for a given signal type. (Usually the signal profile is the trace of signal spectrum shape.)

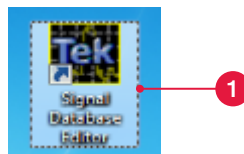


## Create a New Signal Type:

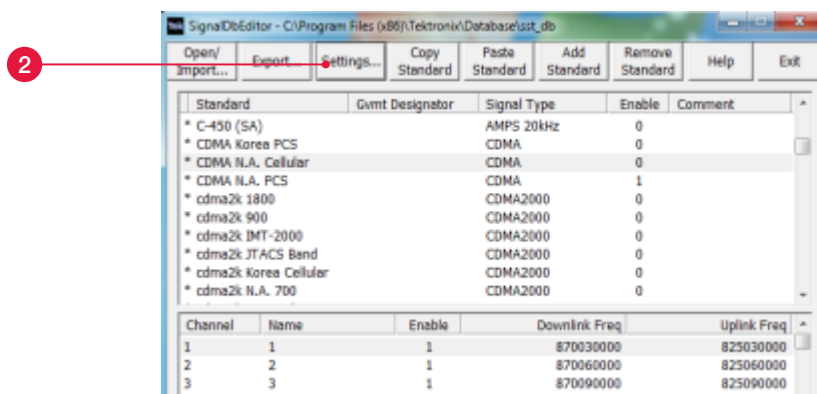
Signal types are characteristics that are common to a group of signals and can be shared by multiple standards. These characteristics can be defined from the signal types section in the settings dialog. Factory defined signal types cannot be edited or deleted. User defined signal types can be created, edited or deleted.

1. Open the **Signal Database Editor** from your PC.

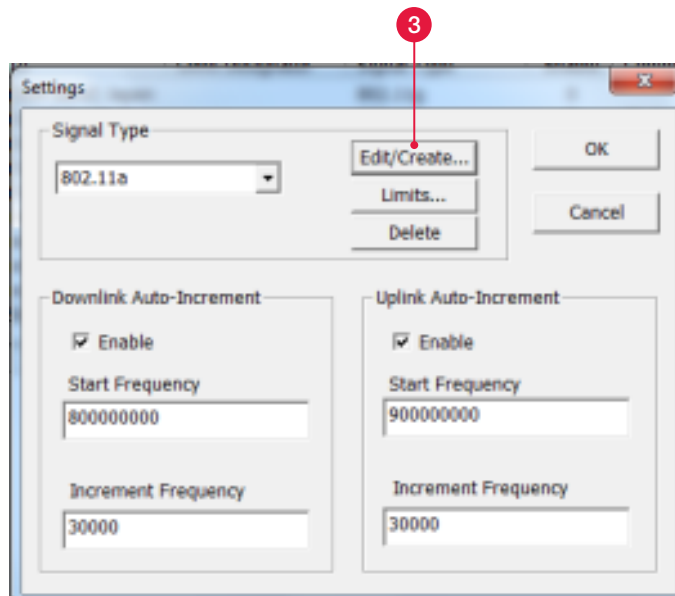
Although this application will run standalone on the product it is intended to be run on a PC for performance and keyboard input reasons.



2. Press **Settings**.



3. Select the **Edit/Create...** button in the settings dialog.



4. Name the Signal Type as Demo LTE.
5. Input the typical **Bandwidth** of the signal type you want to create.  
5 MHz is used in this example.
6. Set the **Match BW** and click **Enable**.  
The signal bandwidth must be within this range to be considered as a candidate.  
This parameter is only used in H500's Signal Classification measurement mode.
7. Select **File** (.CSV) under **Spectral Profile** section.

#### Quick Tip:

Spectral Profile is a visual profile used in H500's Signal Classification measurement mode. This can be used to visually determine whether a signal as seen on the product display matches a stored profile for a given signal type.

- If no profile is specified then no comparison display is seen on the product.
- If "Use Existing" is specified the current profile contained in the database for a copied signal type will be retained. In this case, if a profile does not exist in the database nothing will be displayed.
- If "File" is selected a profile is read from a previously stored comma separated value (.csv) results file. Only user defined signal types can be edited.

More detail information is under the section "Create Your Own Visual Spectral Profile".

8. Load the saved spectrum profile in Step 31.
9. Set the **limit**.

For each measurement you can enable detection, specify default limits and define minimum/maximum limits allowed for user definition within the product.

10. Click **OK**, and this signal type is created.

- Only user defined signal types can be edited.
- Once a signal type has been defined it will become selectable in the standard table as mentioned above.
- Either factory or user defined limits for various measures can be set.

**Signal Type**

Name: Demo LTE (4)

Match BW Low: 4500000

Match BW High: 5500000 (6)

Bandwidth: 5000000 (5)

**Spectral Profile**

☒ File (7) | ram Files (x86)\Tektronix\SA2500PC\lte5.csv (8) | ...

☐ None

☐ Use Existing

☒ Enabled (9)

Enabled	Low Limit	High Limit	Minimum	Maximum
<input type="checkbox"/> Channel Power (dBm)	-100.000	-50.000	-150.000	50.000
<input type="checkbox"/> Field Strength Ave.(dBuV/m)		-90.000	-1000.000	1000.000
<input type="checkbox"/> Field Strength (dBuV/m)		-90.000	-1000.000	1000.000
<input type="checkbox"/> OBW Bandwidth (Hz)	15000000	20000000	0	20000000
<input type="checkbox"/> OBW In-Band Power (dBm)	-100.000	-50.000	-150.000	50.000
<input type="checkbox"/> OBW Bandwidth Ave. (Hz)	15000000	20000000	0	20000000
<input type="checkbox"/> OBW Bandwidth Pk. (Hz)	15000000	20000000	0	20000000

OBW BW Factor: 1

Enabled

OK (10) Cancel

## Create a New Standard:

A standard contains a group of channels with different uplink and downlink frequencies that adhere to the characteristics of a signal type. Many factory defined standards have been provided and distinguished by the asterisk "\*" symbol in the first column of the table. A user can copy/pasted or add user defined standards as well.

11. Press **Add Standard** toolbar button.
12. Name the created new standard as Demo LTE standard.
13. Select the Signal Type as the one we created in Step 10.
14. Click **Setting**.

The auto-increment fields in the settings dialog are used to simplify channel creation.

15. Fill the increment information in **settings**.

From the E-UTRA Operating Band 1, for 5 MHz bandwidth, the start frequency is 2112.5 MHz for the downlink and 1922.5 MHz for the uplink.

The LTE standard sets increment frequency to be 100 kHz.

16. Select **Enable** of downlink auto increment, and unselect **Enable** of uplink auto increment, to add downlink channel only.

17. Click **OK**.

18. Click the channel table and click **Add Channel** to add one downlink channel first.

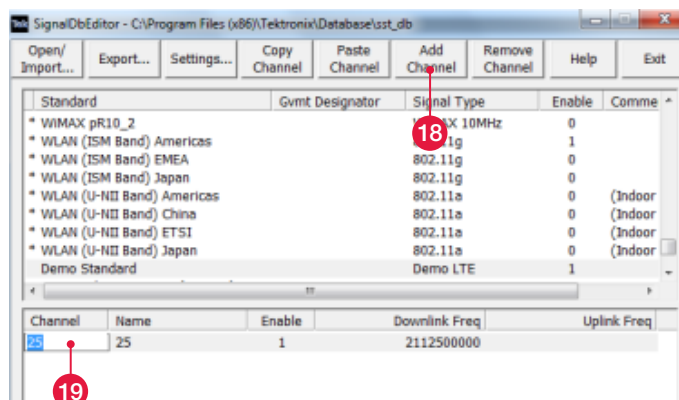
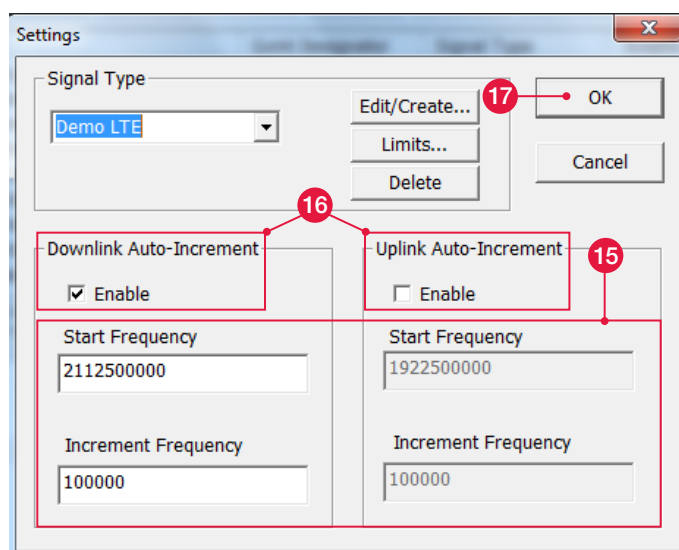
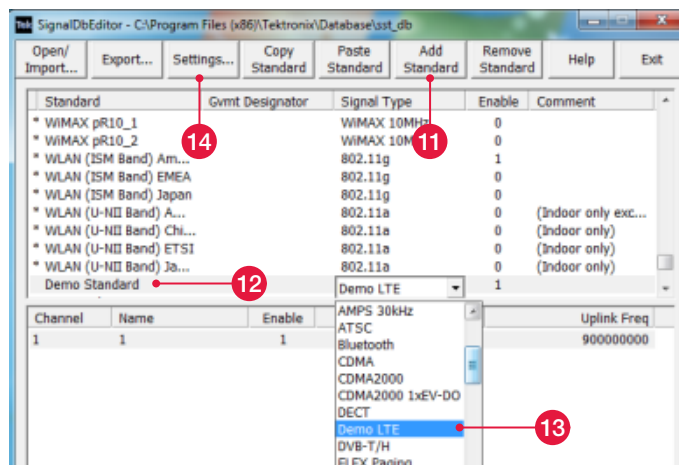
19. Edit the channel number and channel name.

In this example, the first channel number is set as 25, since the downlink channel number of E-UTRA Operating Band 1 starts from 25 for 5 MHz bandwidth LTE signals.

20. Click **Add Channel** again to add more downlink channels.
21. In settings, select **Enable** of uplink auto increment, and unselect **Enable** of downlink auto increment, to add uplink channels as the same method as that of downlink.

### Quick Tip:

- Many factory defined standards have been provided and distinguished by the asterisk "\*" symbol in the first column of the table. These standards cannot be edited or removed but can be copied to a new user defined standard and edited there.
- For convenient editing, the channel table can be exported to a csv file, and imported back to database editor when you finish.



Channel	Name	Enable	Downlink Freq	Uplink Freq
25	25	1	2112500000	
26	26	1	2112600000	
27	27	1	2112700000	
28	28	1	2112800000	
29	29	1	2112900000	
30	30	1	2113000000	
31	31	1	2113100000	

## Create Your Own Visual Spectral Profile:

Spectral profile is used in H500's Signal Classification measurement mode. This can be used to visually determine whether a signal as seen on the product display matches a stored profile for a given signal type. The Spectral profile of a signal could be created by an antenna or signal generator with specific type of signals.

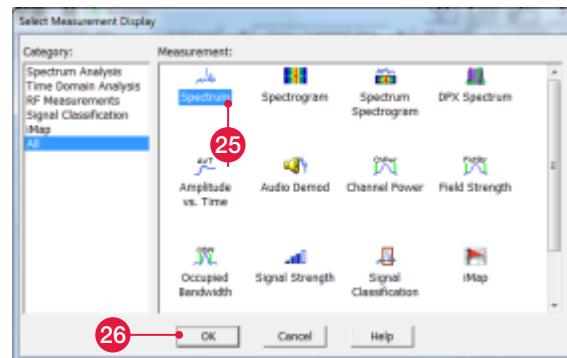
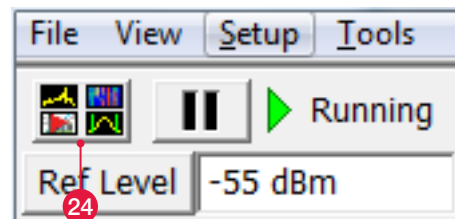
22. Open H500 or H500-SA2500 Remote Client.

23. Connect an antenna or a signal source to H500.

24. Click the **measurement display** selection.

25. Select **Spectrum**.

26. Click **OK**.

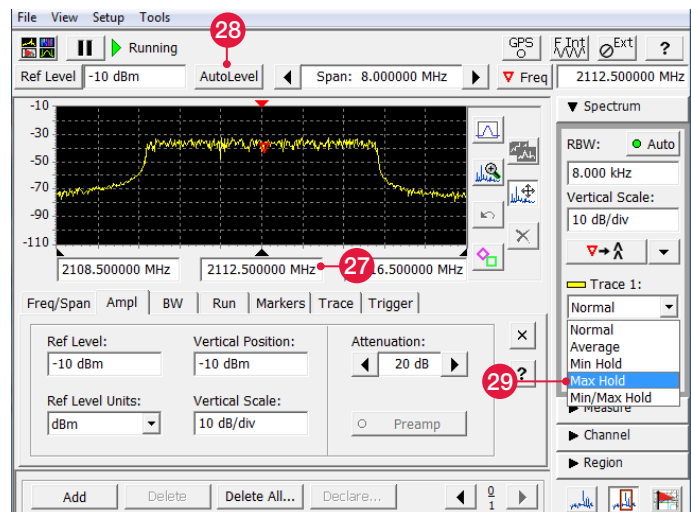


27. Center the trace on a desired signal.

In this example, we capture a LTE 5MHz at the center frequency of 2112.5 MHz.

28. Click **AutoLevel**

29. Set trace 1 to **max hold**.



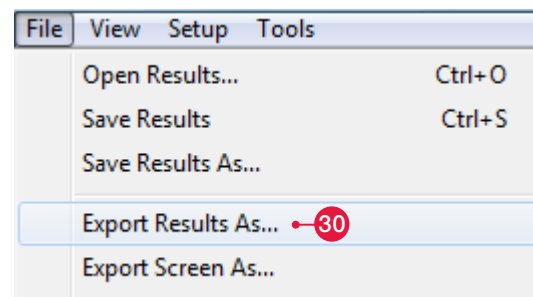
30. Click **Export Results As...**

31. Name the file and save as a .csv file.

In this example, we name this spectrum profile as lte5.csv.

### Quick Tip:

- This will always be the "Trace 1" results contained within the file.
- If you run H500 remote client on PC, the results will be stored in C:\Program Files (x86)\Tektronix\SA2500PC.  
If you do not use remote client, the results will be stored in \BuiltInDisk\500q\AppData\Results



## 2. How To Convert Map To Be Loaded Into H500 With iMap Converter

### Overview:

The iMap Converter tool is an application that converts graphics files (photographs, scanned building floor plans, Microsoft MapPoint web pages) or industry standard geophysical coordinate map files for use with the iMap function on supported Tektronix spectrum analyzer instruments.

The iMap mapping function (available on supported instruments) can use two types of maps: grid and image. A grid map has geophysical latitude and longitude coordinate information embedded in the map file. You use grid maps and a GPS signal to automatically place measurements on the map at your current position.

You can download the free iMap Converter tool from Tek.com:

<http://www.tek.com/spectrum-analyzer/h500-sa2500/sa2500-0-software/imapconverter-pc-application-installation-file-engli>

This Demo guide shows how to use iMap Converter tool to capture map from free Google Earth, and convert it to iMap format supported by mapping measurement of H500/SA2500.



Add Geophysical Coordinate To A Normal Image Map Signal Standard



## Grid Map and Image Map:

- A grid map has geophysical latitude and longitude coordinate information embedded in the map file. You use grid maps and a GPS signal to automatically place measurements on the map at your current position.
- An image map does not have any embedded geophysical information. Typical image maps include building floor plans, aerial photographs, and map-drawing program screen captures.

The iMap Converter tool helps you convert a normal image map to a grid map for H500/SA2500.

## Capture an Image Map:

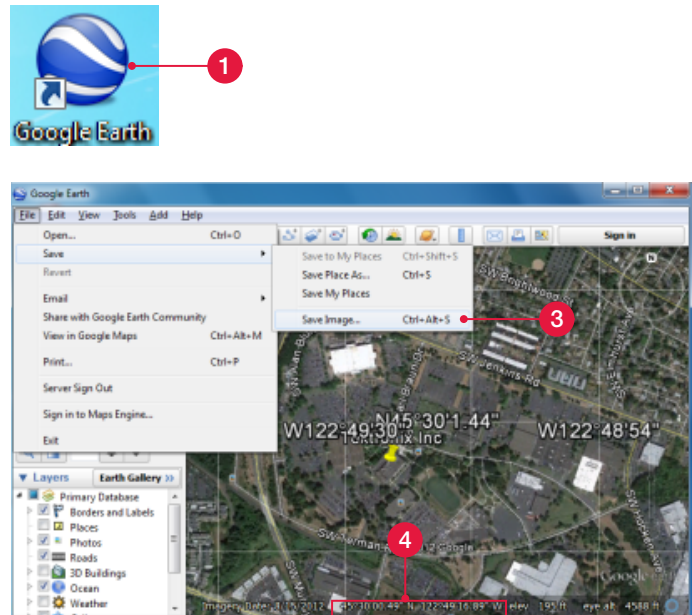
In this example, Google Earth is used for image map capture.

1. Download Google Earth from earth.google.com, install and run.
2. Locate the map you need.
3. Click **Save** and **Save Image** as Demo map.jpg.
4. Choose two points on map and record their coordinates.

As you move the mouse pointer in Google Earth, latitude and longitude coordinates are displayed in the lower right corner.

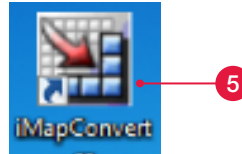
### Quick Tips:

- Another good free online mapping source to capture maps is OpenStreetMap. OpenStreetMap: <http://www.openstreetmap.org/>
- The image must be oriented so that true North is toward the top edge of the image.



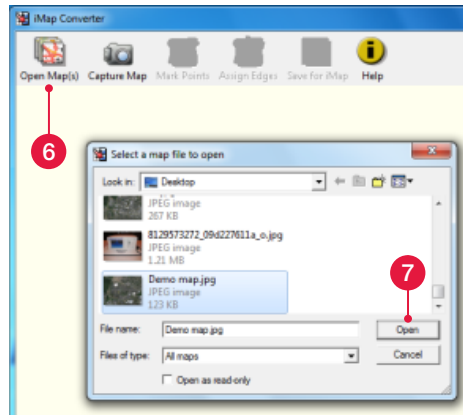
## Create a Grid Map:

5. Run iMap Converter tool.

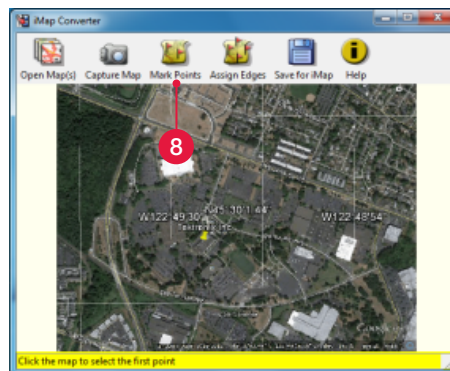


6. Click **Open Map(s)**.

7. Select the map you created in Step 3, and click **Open**.



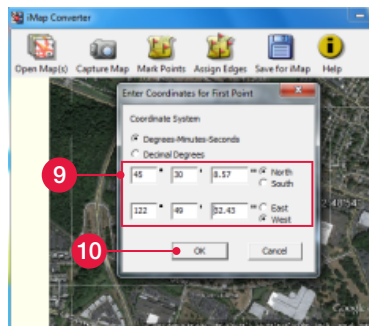
8. Once the map is loaded in to iMap Converter, click **Mark Points**.



9. Click the first point you selected in Step 4, and input the coordinate information.

10. Click **OK**.

11. Input the coordinate information of the second point selected in Step 4, and Click **OK**.



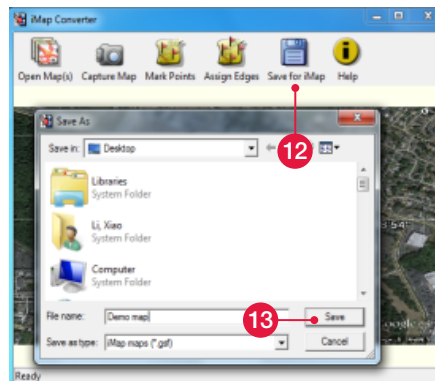
12. Click **Save For iMap** to save the map file.

13. Name the file as Demo map.gsf, and click **Save**.

This saved .gsf file could be used in H500 for mapping measurement.

### Quick Tips:

- The iMap Converter uses the same file extension (.gsf) for both grid and image map file names. Make sure to use a file naming convention to show the difference between grid and image maps when you save map files with iMap Converter.



### 3. How To Export Measurement Results To Free Google Earth Map With Google Earth Mapping Tool

#### Overview:

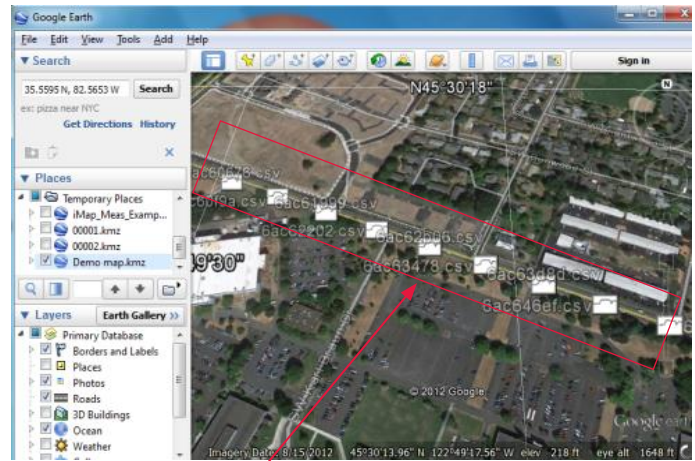
The Tektronix Google Earth Mapping Tool is a free software to help customers export the results of the automatically map logged measurement in H500/SA2500 series portable real time spectrum analyzers to Google Earth.

Using the Google Earth Mapping Tool, H500/SA2500 customers are able to place a quick overview of all the iMap measured results into Google Earth. If any results of interest are found, the zipped .csv files from iMap can be easily accessed to find out all the measurement details.

You can download the Tektronix Google Earth Mapping Tool from Tek.com:

<http://www.tek.com/spectrum-analyzer/h500-sa2500/sa2500-0-software/google-earth-mapping-tool-pc-application-installatio>

Continued from the last demo example, this Demo guide shows how to use Tektronix Google Earth Mapping Tool to convert the Log Multiple iMap measurement results of H500 to Google Earth file format, and display in Google Earth



Automatic Measurement  
Results From H500

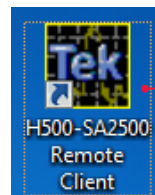
## Perform Log Multiple Map Measurement on H500/SA2500:

The iMap Log Measurements function lets you automatically attach multiple measurements to a map based on a time interval or a geophysical location change (when used with GPS). Measurements are taken at the specified interval or distance change until you turn off the Log Measurement function.

In this example, the .gsf iMap file created by iMap converter in last demo example is used to perform a log multiple map measurement on H500.

Please skip this step if you already have your .zip file exported from H500.

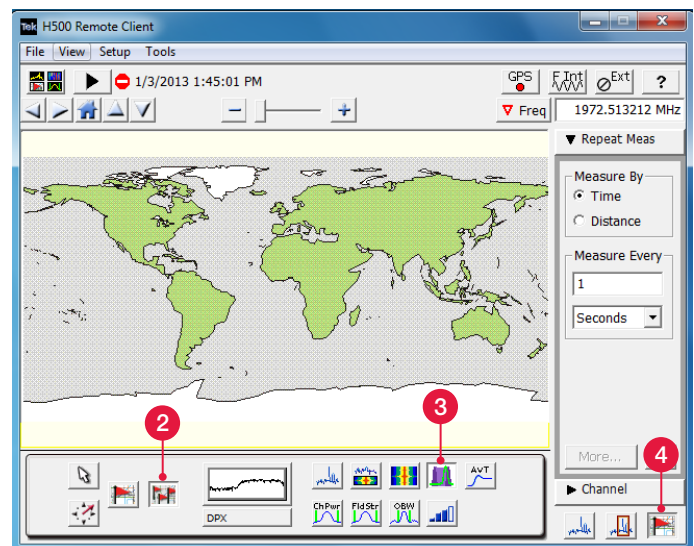
1. Run H500 or H500-SA2500 Remote Client.



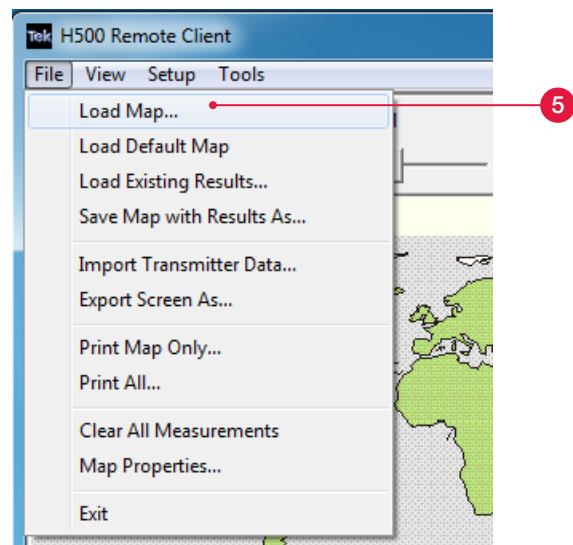
2. Select **iMap** measurement.
3. Tap one of the iMap Measurement Buttons to select the measurement to map.

The example shows selecting the **DPX** measurement.

4. Tap the **Log Measurements** button.



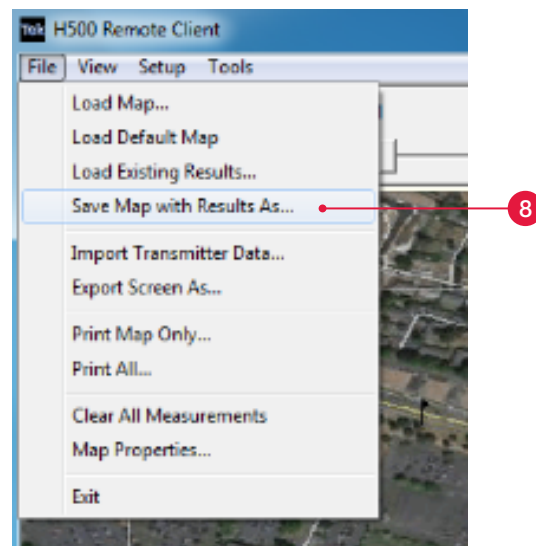
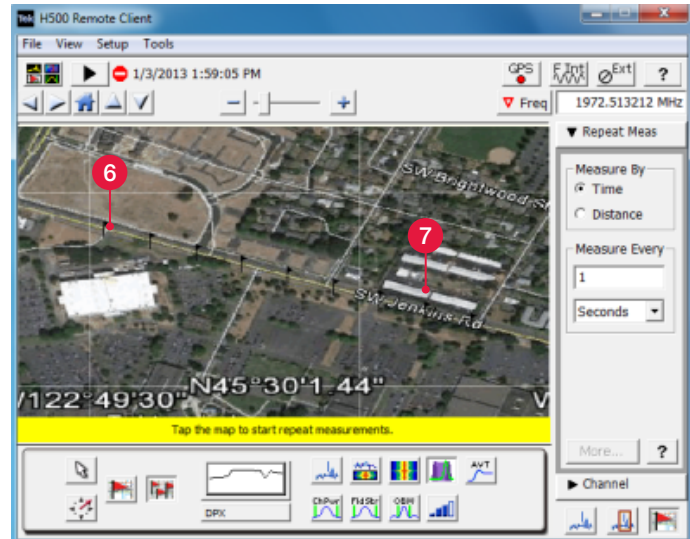
5. Select File > Load Map and load a grid map.  
Demo map.gsf created in Demo Example 2 is used.



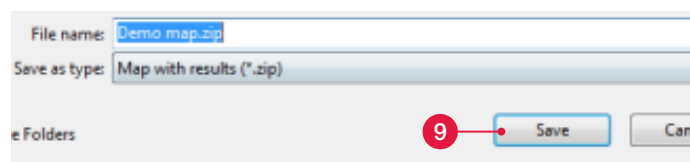
6. Tap the map at the measurement starting location to start logging measurements.
7. Tap the map at the position the last measurement was taken to stop logging measurements.

#### Quick Tips:

- To start logging measurements:
    - For grid maps with an active GPS receiver, tap the map at any point. The instrument begins adding measurement flags to the map at the current GPS position.
    - For image maps, or for grid maps without an active GPS receiver, tap the map at the measurement starting location. The instrument begins taking measurements, but does not display them on the map. Walk or move to the stop point at an even speed.
  - To stop logging measurements:
    - For grid maps with an active GPS receiver, tap the map at any position. Measurements are then placed on the map at the measurement locations.
    - For image maps (or grid maps without an active GPS receiver), tap the map at the position the last measurement was taken. Measurements are then evenly spaced between the start and stop map points.
8. Select **Save Map with Results As...** under File to create a “.zip” file of the iMap measurement results.



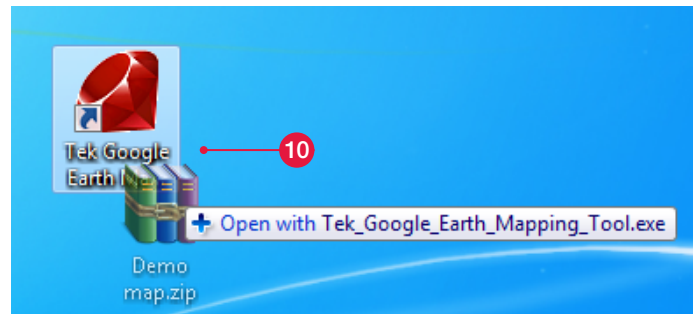
9. Name the file as Demo map.zip, and click **Save**.  
This saved .zip file could be used for Tektronix Google Earth Mapping Tool to Convert to Google Earth File Format.



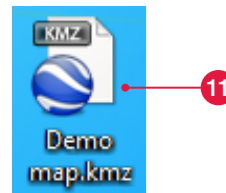


## Convert to Google Earth File Format:

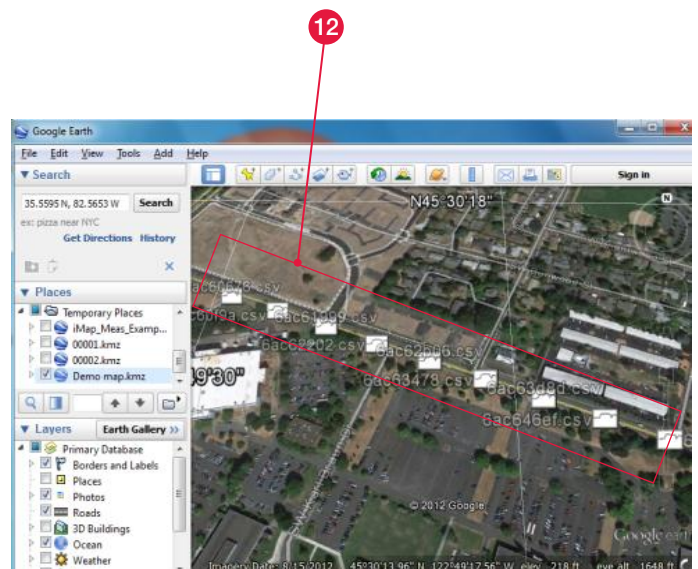
10. Drag the the .zip file saved in Step 9 onto the “Tek Google Earth Mapping Tool” desktop shortcut.



11. Once the conversion is completed, a .kmz file (with the same file suffix as that of the .zip file) will be placed in the same directory as the ZIP file.  
This .kmz file could be opened in Google Earth for analysis.



12. Double-click the “.kmz” file, and Google Earth will automatically open with the measurement results displayed on a map.



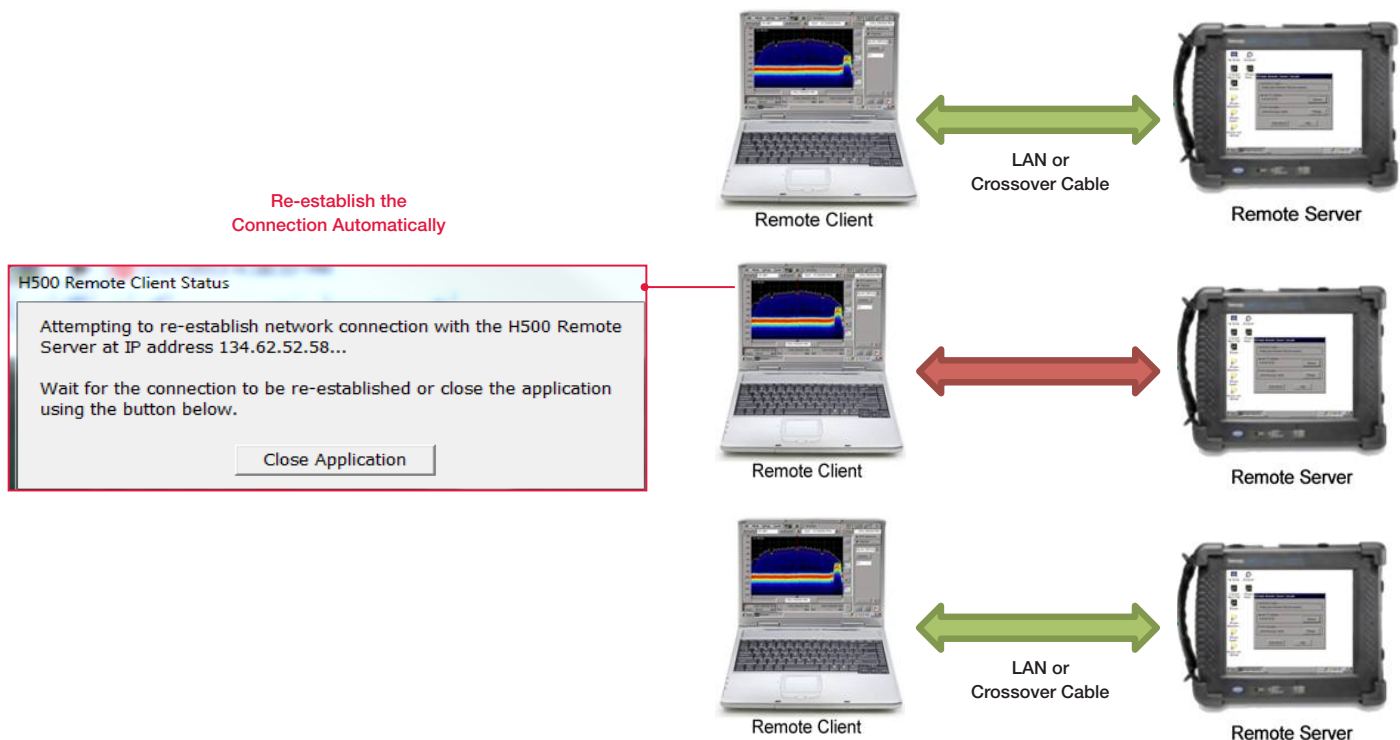
## 4. How to Remote Control H500 in The Field with Remote Client/Server

### Overview:

The Remote Client/Server operation mode lets you run the PC-based H500 or SA2500 application as a "client" that connects through the network to a "server" running on an H500 or SA2500 instrument. The Remote Server is a very light-weight application that monitors the network for requests from the Remote Client. The Remote Server interfaces directly to the low-level application module interface, providing a very efficient and fast mechanism for controlling the application module hardware.

In general, if the PC running the Remote Client can "ping" the IP address of the instrument running the Remote Server, then you should be able to make a Remote Client/Server connection. The connection between Remote Client and Remote Server could be re-established automatically when network is recovered after interruptions.

This Demo guide shows how to establish a connection between the Remote Client and Remote Server.



## Remote Server Operation:

The Remote Server capabilities are automatically installed whenever new H500 or SA2500 application SW is loaded onto an H500 or SA2500 instrument.

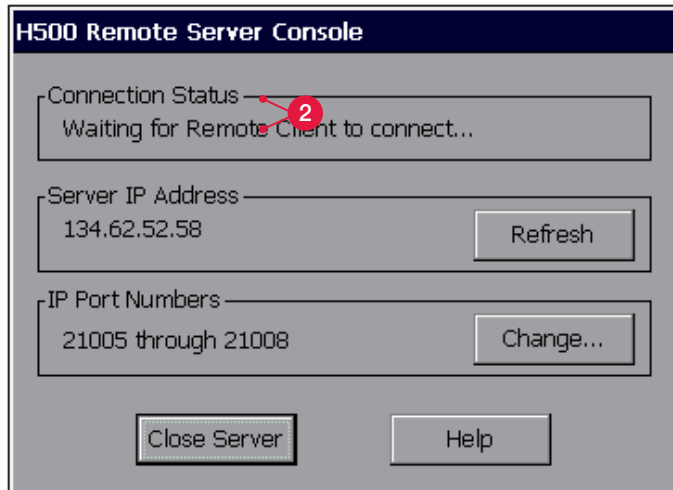
1. Click the **Remote Server** on the desktop of H500 instruments.



2. Record the **Server IP Address** and **IP Port Numbers** shown in the Remote Server Console.

### Quick Tips:

When the Remote Server is connected to a Remote Client, the "Connection Status" changed from "Waiting for Remote Client to connect..." to "Connected to Remote Client at NNN.NNN.NNN.NNN".



## Remote Client Operation:

The Remote Client application is the PC version of the H500 or SA2500 application launched with a given command line parameter that specifies to the application to run in Remote Client mode. The Remote Client capabilities are available after installing either the "Tektronix H500 Spectrum Analyzer PC Applications" or "Tektronix SA2500 Spectrum Analyzer PC Applications" SW package on the target PC.

3. Click the **H500-SA2500 Remote Client** on your PC.

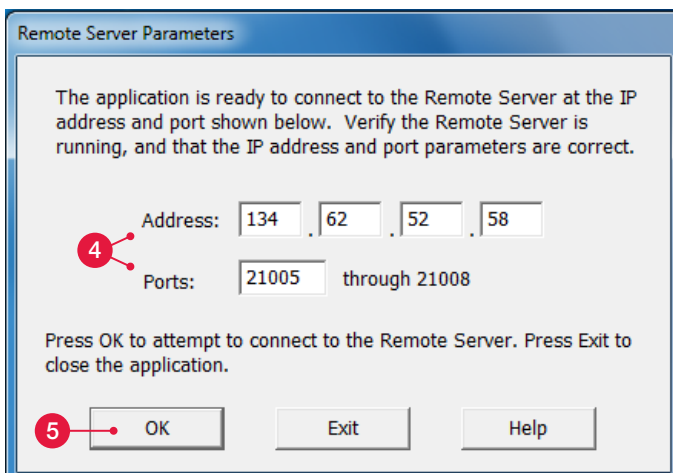


4. Specify the **Server IP Address** and **Ports** recorded from Remote Server in Step 2.
5. Click **OK**.

### Quick Tips:

To monitor multiple Remote Servers in the field, use one of the following methods:

- Use multiple PC's, each running a Remote Client connected to a unique Remote Server.
- Use a single PC, but connect to each Remote Server one at a time.





## Recovering From Network Interruptions:

The Remote Client and Server have been designed to tolerate network interruptions of between 5 to 10 seconds. The only observable symptom would be no measurements being taken during this period of time. For longer network interruptions, or in cases where the network connection is lost, the Remote Server reverts to the "Waiting for Remote Client to connect..." state and the Remote Client will (after a 20 second timeout period) start attempting to re-connect to the same Remote Server.

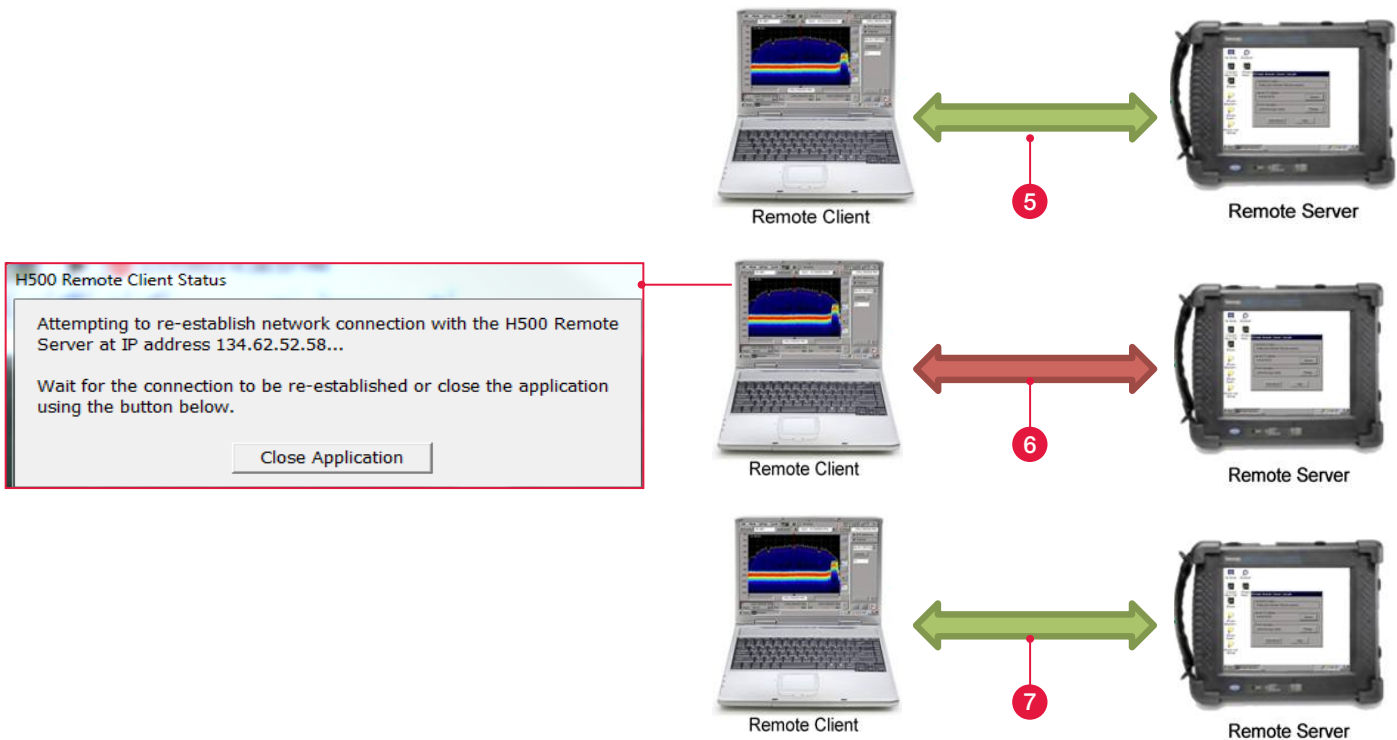
6. Disconnect the cable between Remote Server and Remote Client for more than 10 seconds.

While attempting to reconnect, the Remote PC Client status will display a dialog box as "Attempting to re-establish network connection with H500 Remote Server at IP address..."

7. Reconnect the cable between Remote Server and Remote Client.

When the Remote Client re-establishes the network connection with the Remote Server, then this dialog box is automatically dismissed and the application resumes running from the state it was in prior to the lost connection.

If the connection cannot be re-established, use the "Close Application" button to shut down the Remote Client application.



## 5. How To Provide Remote Technical Assistance With Command Macro Tool

### Overview:

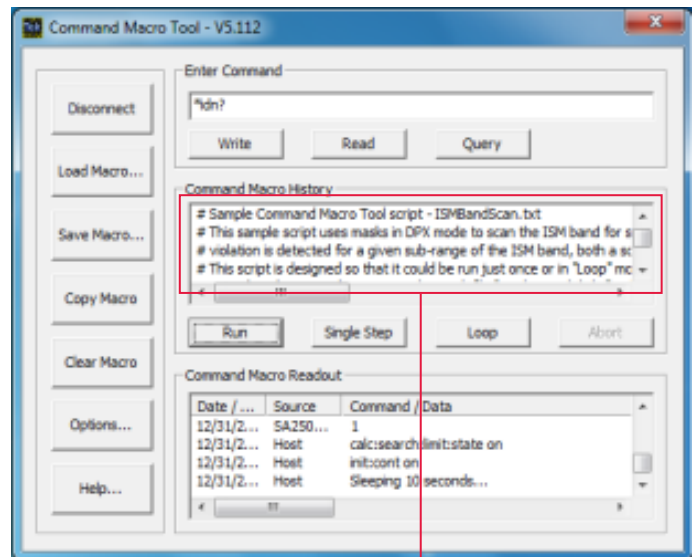
The H500/SA2500 Command Macro Tool allows the user to define a sequence of commands (i.e., a macro) that will control the H500 or SA2500 application. These commands are any valid H500/SA2500 programmable interface command, which are sent via a network connection from the Command Macro Tool to the target application.

You can download the free H500/SA2500 Command Macro Tool from Tek.com:

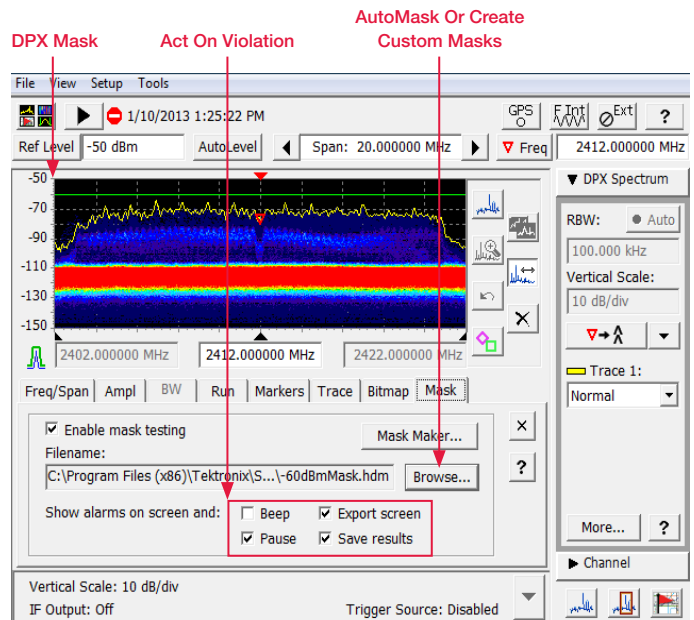
<http://www.tek.com/spectrum-analyzer/h500-sa2500/sa2500-0-software/command-macro-tool-pc-application-installation-file->

This Demo guide shows how to use Command Macro Tool to scan the ISM band in DPX mode and detect for signal violation automatically.

Marco Running on Remote PC



H500 Live Measurement Running On Remote PC

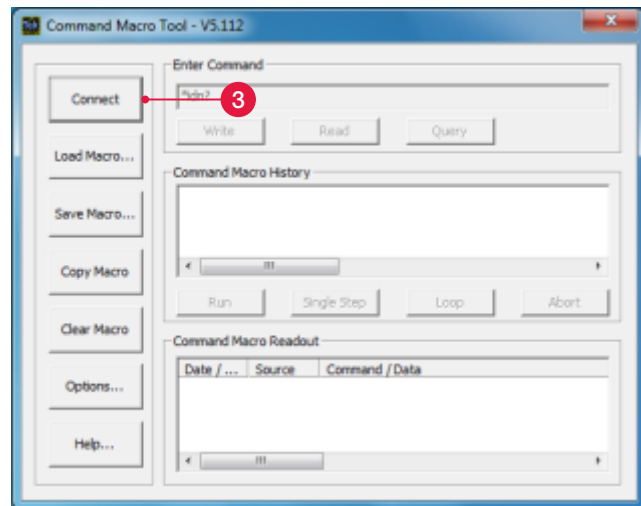


## Operating Procedures:

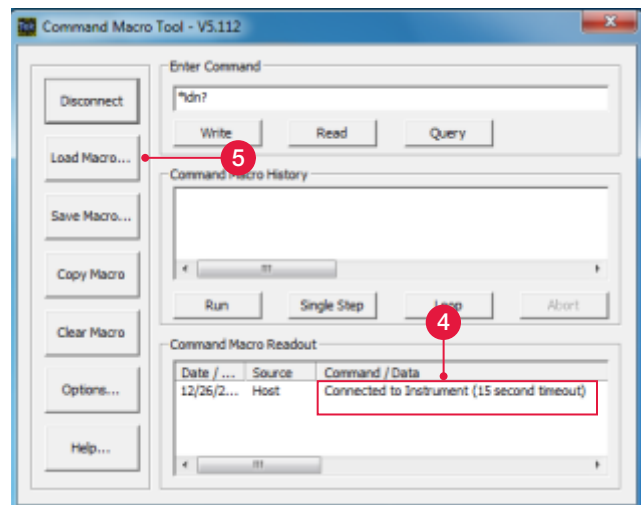
1. Establish a connection between the Remote Client and Remote Server as "4. How to remote control H500 in the field with Remote Client/Server".
2. Click **Command Macro Tool** on your PC.



3. Click **Connect**.



4. Check **Command Macro Readout** to make sure the Marco is connected to instrument.
5. Click **Load Macro...**

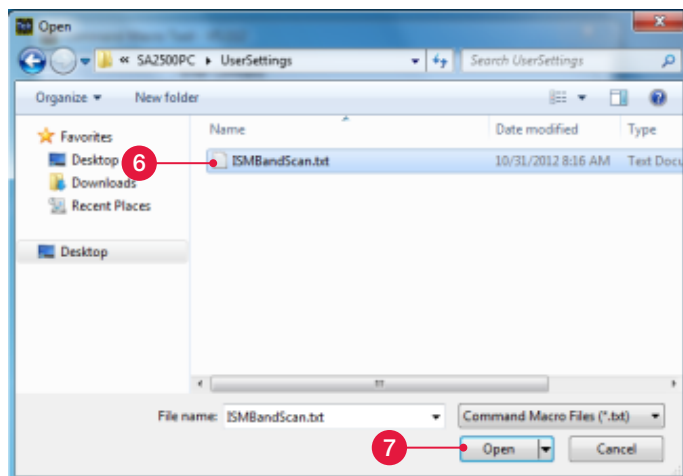


6. Select the desired command script.

In this example, navigate to the path named C:\Program Files (x86)\Tektronix\SA2500PC\UserSettings and click the file named **ISMBandScan.txt**.

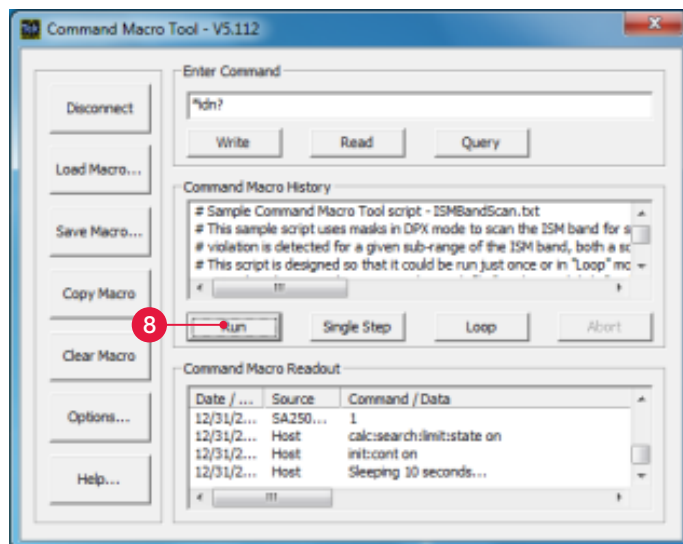
7. Click **Open**.

The script file will be loaded into Command Macro History window.



8. Click **Run**.

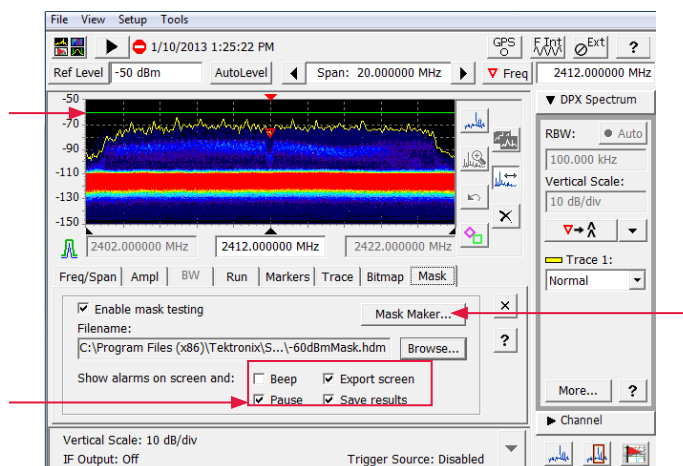
Command Macro Tool will send script to H500 for designed measurements.



### Quick Tips:

- This script is designed so that it could be run just once or in "Loop" mode. You can execute the currently selected line from the Command Macro History window using "Single Step" or run the current macro continuously using "Loop".
- The default place for the saved violation files is C:\Program Files (x86)\Tektronix\SA2500PC.

This sample script uses masks in DPX mode to scan the ISM band for signals that exceed -60dBm. If a mask violation is detected for a given sub-range of the ISM band, both a screen shot and stored results are saved.





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### For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com)



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