![FREEDOM Communication Technologies]

Application Note:
Utilizing Cable Sweep on the Freedom Communications System Analyzer

Application Note

The purpose of this application note is to demonstrate the use of Cable Sweep on the R8000 or R8100 to create "test cable" characterizations that can be saved and later recalled. The Cable Sweep function provides an easy way for the user to determine the loss characteristics of a test cable across frequency and store that information within the R8xxx unit by a user defined name. Up to fifty cable files can be stored on the R8xxx.

The Cable Sweep function is available on software versions 3.8 and higher.
Note: Cable Sweep utilizes the "tracking generator" to create the multi-point loss data, so the Tracking Generator option (R8-TG) is required. Without the R8-TG option the software will still allow the user to create multiple two point cable sweep tables.

The descriptions and screen shots utilized in this application note are based on an R8100 running software version 3.8 or later. The test unit also has Tracking Generator (R8-TG) option enabled.

In text below the writer assumes the user has a working knowledge of the R8000/R8100 platform. If the user is new to the R8000/R8100 then it will be helpful to review the appropriate O&M manual which can be found online at
www. freedomcte.com

Cable Sweep Background Information

The R8000 product has always had the ability to allow a user settable RF offset (loss) to any of the generate or receive ports. However, when testing a multi-band radio, it is important to account for test cable loss across frequency. In earlier versions of software, the R8000 accomplished this by giving the technician the ability to set cable loss (in dB) at two points (100Mhz and 1000Mhz). The R8000 would then calculate the loss at operation frequencies. That two-point function was called "Cable Sweep" and when enabled the loss adjustment supported both manual testing and AutoTune testing. Only one two-point set of values could be entered and saved as part of a preset.

For R8000 software release 3.8 Freedom has expanded the Cable Sweep function to support multiple files of both two-point sets and multi-point sets. The two-point sets are configured by a technician entering values based on datasheet for the test cable in use. The multi-point sets are configured by using the R8000 test set to measure loss of a specific test cable from 30Mhz to 1000Mhz and store this information in a named file.

Cable Sweep Setup

The creation and management of the Cable Sweep tables is supported in the "System Settings" menu. The menu is found by pressing the [Settings] key and then "System Settings…" soft key.

In the lower part of the screen the user will see "Cable Sweep" On/Off and "Selected" (name) which indicates when Cable sweep is enabled and what file is in use. (See screenshot)
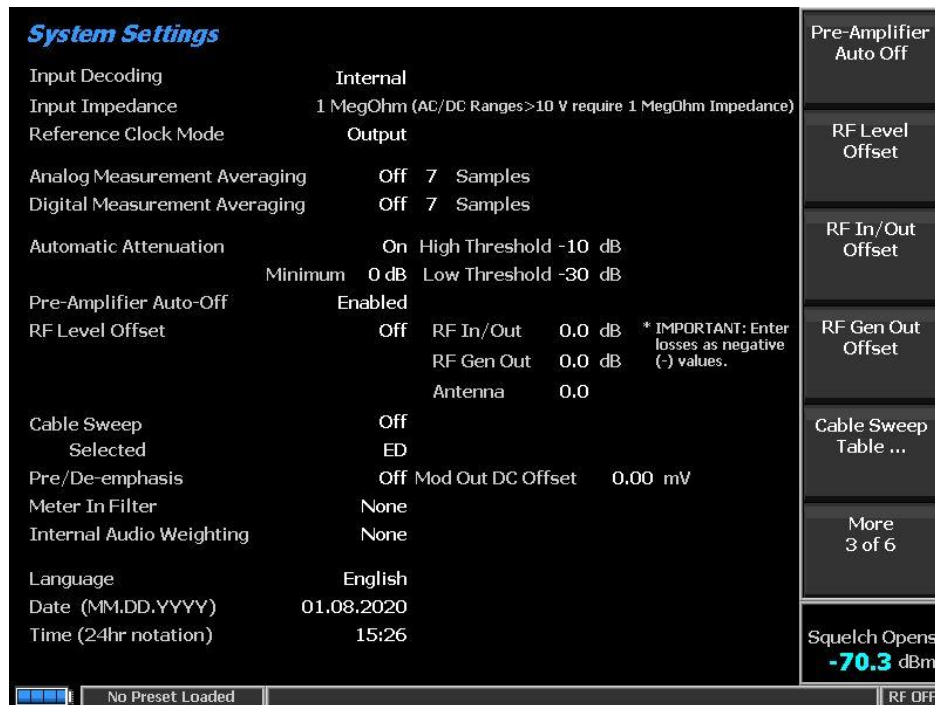
Paging the softkey menu user will find the following three softkeys:

Cable Sweep Table…
        This softkey opens a new menu and screen that provides all support to create, save, delete export and import cable sweep files.

Cable Sweep Enable
        This menu item provides a drop-down Off/On selection. The user can set if a cable sweep file is used or not in adjusting the signal level.

Cable Sweep File
        This menu item provides a drop-down selection of currently available cable sweep files available on the unit. The user can select the file to make 'current in use" from the list.
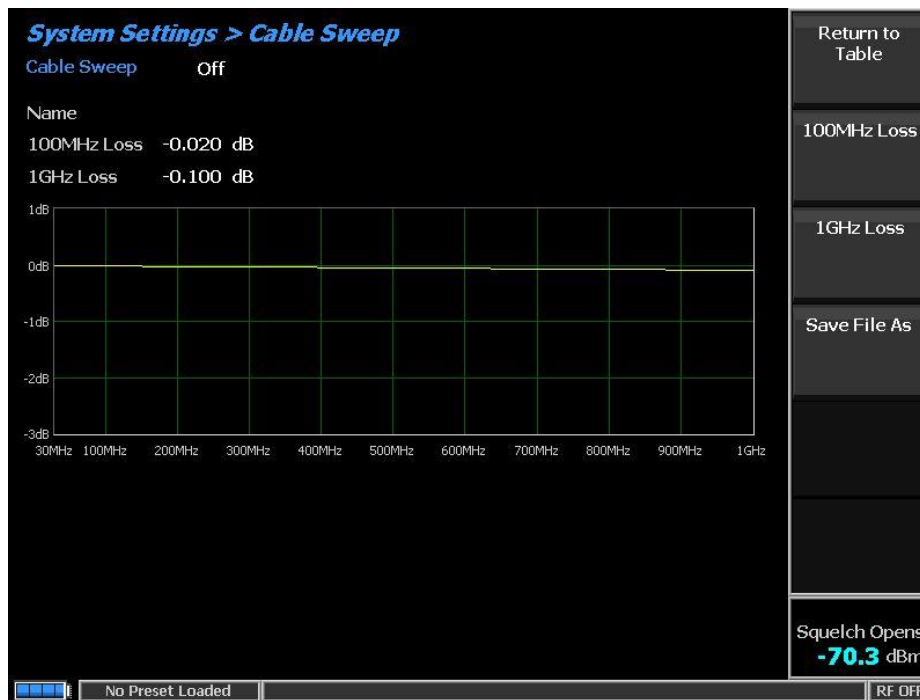
Below is screenshot of the Cable Sweep Menu found under the "Cable Sweep Table…" softkey.
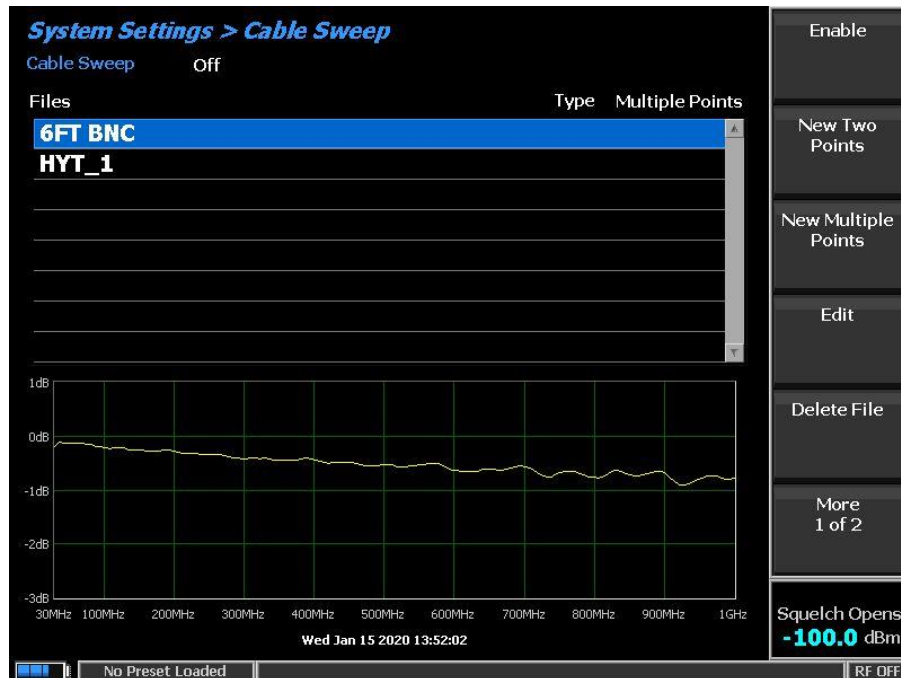
Creating A Two Point Table

Select the softkey "New Two Points" which will open the following screen and menu:

Select "100Mhz Loss" softkey to enter the datasheet loss of the test cable at 100Mhz.

Select "1Ghz Loss" softkey to enter the datasheet loss of the test cable at 1Ghz.

The screen plot will show the loss results across the span.
Select "Save File As" to enter a name for the information to be saved on the R8xxx.
The name can be 16 characters long – made of uppercase text/numbers and some symbols.

Creating a Multi-Point Table

Creating a Multi-Point table is a multi-step process.

NOTE: It is necessary to follow on-screen instructions carefully to get good results.

Select the softkey "New Multiple Points" to initiate the first step of creating a multi-point table.

Quick initialization is performed setting up the tracking generator in the background.
After setup is complete the user will see the follow screen:
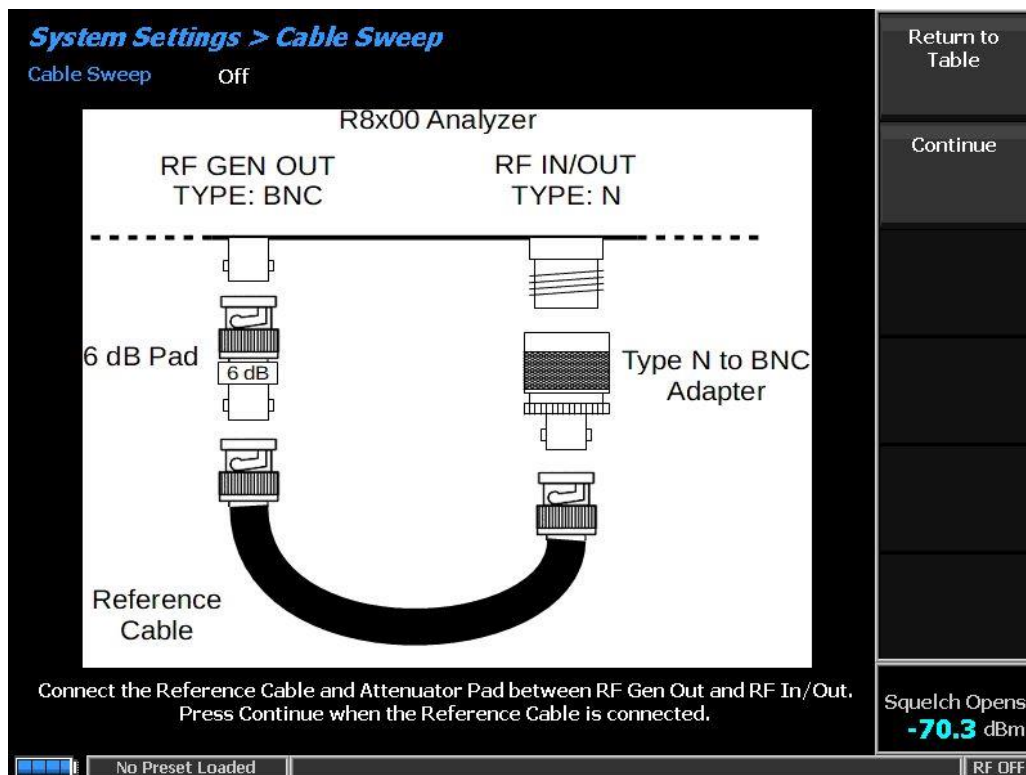
The screen asks the user to connect a reference cable between the Gen Port and the RF I/O port.
NOTE: To minimize the effect of impedance mismatch across frequency a 6dB attenuator must be placed in line with the reference cable. The 6dB attenuator will stay in line with the reference cable when the test cable is connected.

When the reference cable with 6dB attenuator is connected hit the "Continue" softkey.

The unit will measure and normalize the loss of the reference cable with 6dB attenuator.

When ready to move on the next screen will be seen:
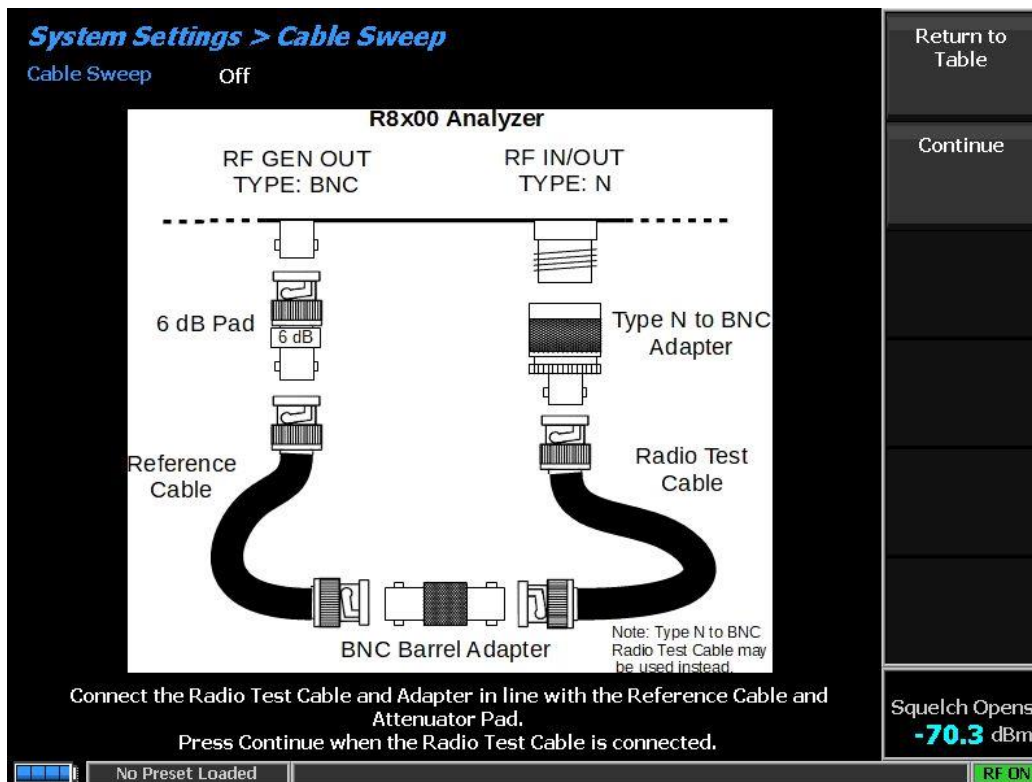
Now connect the "test cable" in line with the reference cable.
Note: It is important that the "test cable" be located on the side facing the RF I/O port.
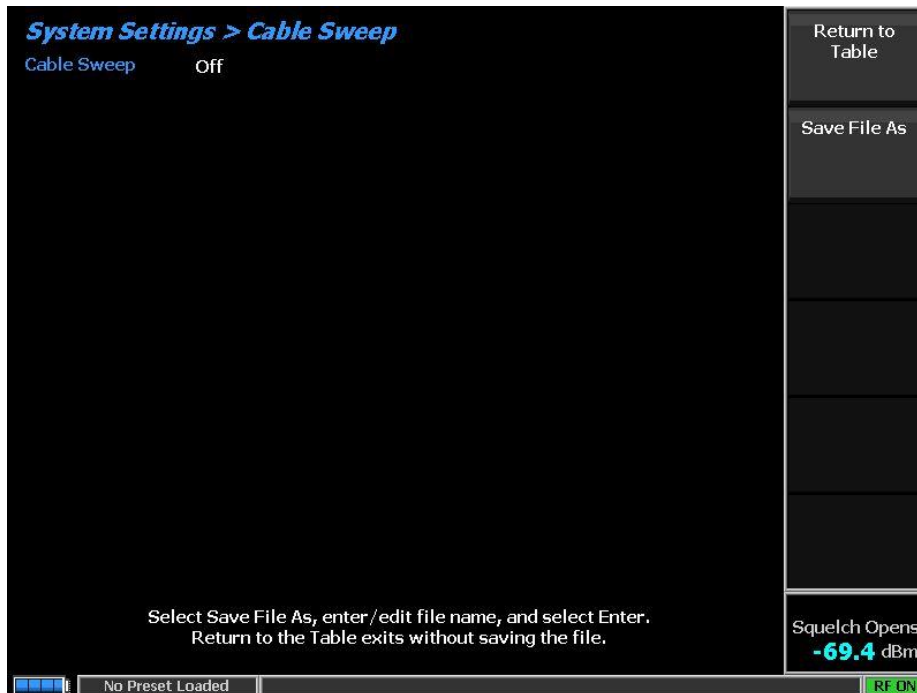Some type of barrel adaptor will be needed to connect the two cables.
Note: the screen shots show BNC cables, but of course Type N cables could be utilized as well.

When the test cable is connected to reference cable as shown hit the "Continue" softkey.

The R8xxx system will measure the cable loss and then give user opportunity to save the data.

Select "Save File As" to enter a name for the information to be saved on the R8xxx.
The name can be 16 characters long – made of uppercase text/numbers and some symbols.

After the data is saved the screen will return to the "Cable Sweep Table" and user will be able to "see" the results of the cable.
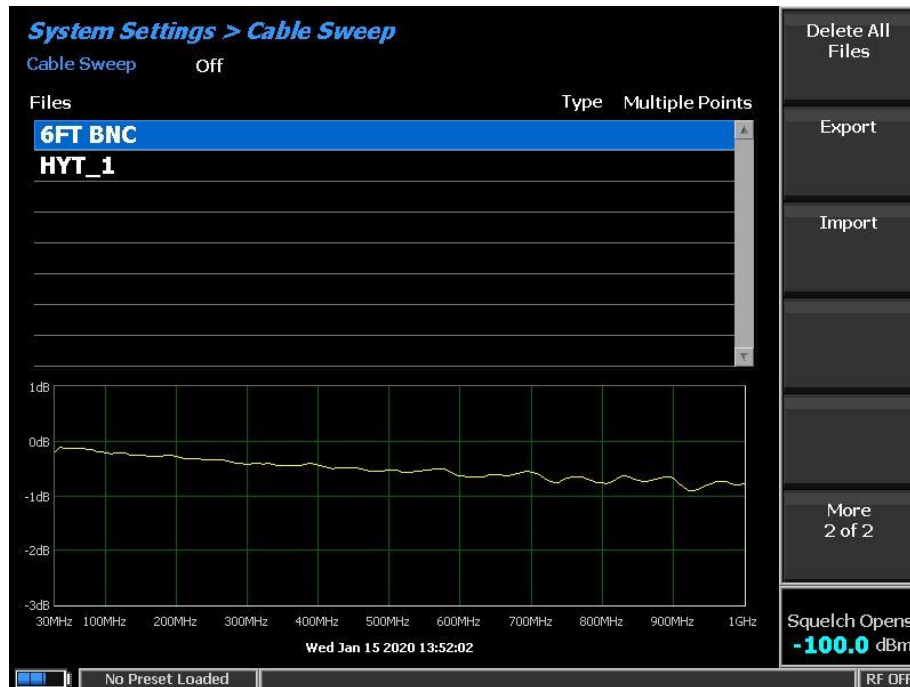
See screenshot below:
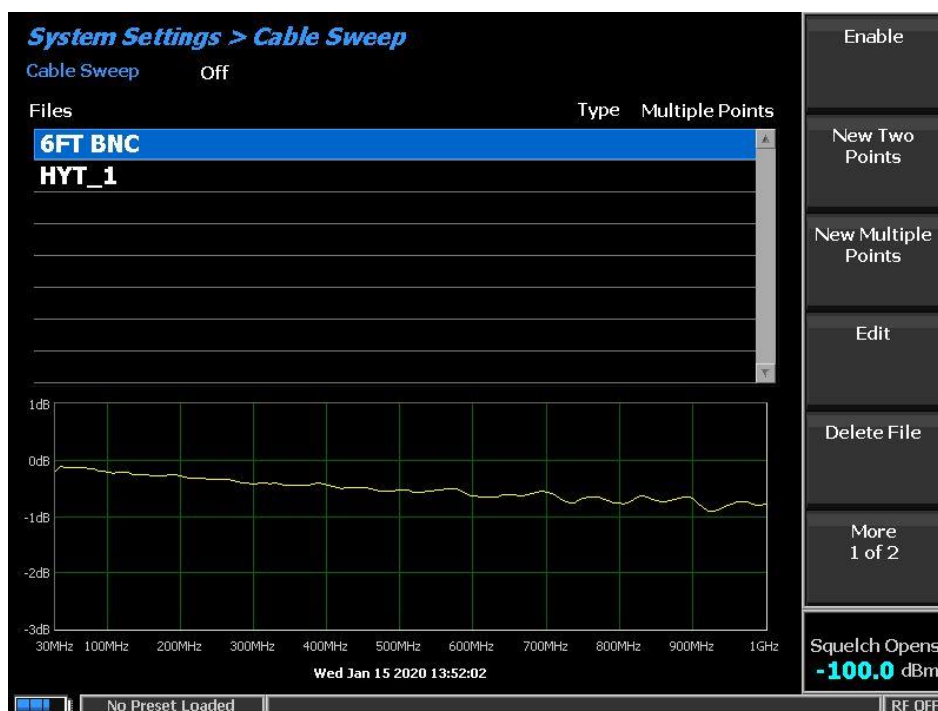
On the above screen the file "6FT BNC" data is shown in the graphic plot below the list.

User can now review the data.

Options are available to delate a selected file or delate all files.

User can also Export or Import a table of Cable Sweep files. A USB drive must be plugged into the R8xxx to see the Export or Import selections. See screen shot below.


"Cable sweep data" can be utilized for power measurements during normal operation or Autotune operation.

"Cable Sweep Enable" and "Cable Sweep File" selection can be made in the settings menu, with the setting shown on the System Settings Screen.

The Enable and file selection can also be performed under Autotune operation. When in the Autotune menu select "Tools" softkey and then "Preferences" softkey.

This will open the Autotune preferences screen where the user can enable or disable the cable sweep and select a specific file to utilize during Autotune operation. See next screenshot.
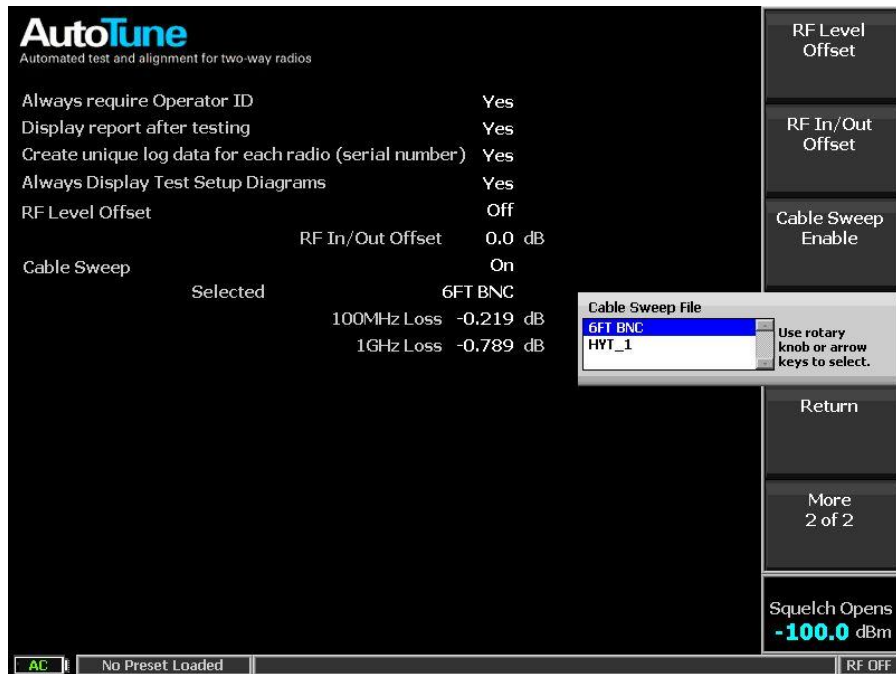
Conclusion

The R8000/R8100 product gives the technician the ability to measure and save loss characteristics of multiple test cables. These stored characteristics can be recalled later to be utilized to improve RF power measurements of radios across a wide frequency range. When utilizing AutoTune to test and align multi-band radios it is recommended that the cable sweep function be utilized.