Quick Reference Guide

Keysight FieldFox Microwave Analyzers

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KEYSIGHT TECHNOLOGIES

Do you have everything?

- FieldFox –To check for installed options, press **System** then **System Configuration** then **Options** then **Show Options**
- Phase stable jumper cable or adapters – Used to connect the FieldFox to devices with various connector types and gender.
- Attenuators – Reduces power and prevents damage to the FieldFox at the RF IN port.
- Cal Kit – OSL Tee or other calibration devices.
- SD card or USB flash drive – Save files to these devices for quick download to a PC.
- USB Power Sensor – For making Power Meter measurements. (Opt 302)
- Battery charger or extra battery

The Power Button and LED

- To turn power ON, briefly press the power button. The LED is green. The boot-up takes about 60 seconds.
- To switch to Standby power (low battery drain) briefly press the power button. A 10 second counter is displayed that allows you to choose **Standby** / **Shutdown** / **Restart** or to let the countdown counter expire after 10 seconds then perform the action. The LED is green and blinks slowly. To turn power ON, briefly press the power button. Power and settings are restored instantly.
- To turn Power OFF (very low battery drain) press the **Shutdown** softkey (For details, refer to previous Standby bullet). The LED is OFF, or solid amber, if AC power is connected.

Battery Usage

A fully charged battery should last about four hours.
Battery charge status is viewable:

- In the upper-right corner of the screen.

- On the battery. To view the LCD gauge on the Inspired Energy battery, open the FieldFox battery compartment door.

To conserve battery power:

- Use **Hold** (**Run/Hold**) mode to trigger a measurement only when needed. **Hold** is shown on the display.
- Press **System** then **Display** then **Brightness** then dim the FieldFox display as much as possible.
- Press the power button and press the **Standby** softkey when not being used. Press again to restore power. All current settings are preserved.

The FieldFox will shutdown automatically when battery power is very low to prevent it from being completely discharged.
Use ONLY a FieldFox charger to recharge a battery.
The battery can be fully charged while in the FieldFox in about 4 hours with the FieldFox either ON or OFF.
A fully discharged battery takes about 1.5 hours to recharge to 80%.
The battery can be fully charged in about 4 hours using the external battery charger (Opt 872).

Measure Return Loss (CAT Mode)

Return loss can be thought of as the absolute value of the reflected power as compared to the incident power. When measuring an OPEN or SHORT, all incident power is reflected and 0 dB return loss is displayed.
When measuring a LOAD, very little power is reflected and values of 40 dB to 60 dB are displayed.

1. Connect the Device Under Test (DUT).
2. Select **Preset** then **Preset (Factory)** Returns the FieldFox to known settings.
3. Select **Mode** then **CAT** (Cable and Antenna Test)
4. Then **Meas Setup 4** then **Return Loss** (Default measurement).
5. Press **Freq/Dist** and enter **Start** and **Stop** frequency values of the measurement.
6. Press **Meas Setup 4** then **Settings** to make appropriate settings before calibrating.
7. Disconnect the DUT and press **Cal 5** then follow the calibration prompts.
8. Reconnect the DUT (cable to be tested).

Optional

- Add Markers – All Modes except VVM and Power Meter
- Add Limits – All Modes except VVM and Power Meter
- Save Settings and Data – All Modes

Measure 1-Port Cable Loss (CAT Mode)

Required Equipment:

- LOAD with correct connector type and gender to terminate the end of the DUT.
- Optional phase stable jumper cable or adapter to connect the beginning of the DUT to the FieldFox.

1. Press **Preset** then **Preset**
2. Then **More** then **Cable Loss (1-Port)**
3. Connect the DUT.
4. Press **Freq/Dist** and enter **Start** and **Stop** frequency values of the measurement.
5. Press **Sweep 3** then **Min Swp Time**. Increase the sweep time until a stable trace is visible on the screen.
6. Press **Cal 5** then follow the calibration prompts.
7. Connect the DUT (cable to be tested) to the FieldFox and connect a LOAD at the end of the DUT.

Depending on the DUT, the following three steps may improve the amount of ripple visible on the screen.

8. Press **Trace 6** then **Math and Memory**, then **Data->Mem**.
9. Remove the LOAD and leave the end of the DUT open.
10. Press **Data Math** then **Data – Mem**. Use Averaging for high-loss measurements. Press **BW 2** then **Averaging**
11. Read **Avg Cable Loss** on the FieldFox screen.

Required Equipment:

- LOAD with correct connector type and gender to terminate the end of the DUT.
- Known length and cable type or Cable Loss (dB/Meter) and velocity factor of the DUT.
- Optional phase stable jumper cable or adapter to connect the beginning of the DUT to the FieldFox.

1. Connect any necessary jumper cable or adapter to the FieldFox RF OUT port.
2. Press **Preset** then **Preset**
3. Then **Mode** then **CAT**
4. Then **Meas Setup 4** then **Distance to Fault**
5. Press **Freq/Dist** then **Stop Distance** and enter the length of the DUT.
6. If a diplexer or other filter is in the measurement path, press **Meas Setup 4** then select **Freq Mode** then **Bandpass**. Then press **Freq/Dist** and manually type the **Min Start Freq** and **Max Stop Freq** frequencies.
7. Press **Cal 5** and follow the Cal prompts.
8. Disconnect any components or antenna that should NOT be measured and connect a LOAD at the end of the DUT.
9. Press **Meas Setup 4** then **DTF Cable Specifications**.
10. Either press **Edit/Save/Recall Cables** or enter the **Velocity Factor** and **Cable Loss** manually--using **Cable Corr** **[Manual]**--of the DUT.
11. Connect the start end of the DUT to the FieldFox. The DTF measurement is displayed.

S-parameter syntax is described by the following:
S (out | in)

out = FieldFox receiver port
in = FieldFox source port

1. Press **Preset** then **Preset**
2. Press then **Mode** then **NA** then choose from the following:

- **S11** 1-port reflection measurement.
- **S21** 2-port transmission measurement.
- **S12** Reverse 2-port transmission measurement. Requires the full 2-port S-parameter option.
- **S22** Reverse 1-port reflection measurement. Requires the full 2-port S-parameter option.

OR Press **Trace 6** then **Num of Traces** then select a Multi-trace configuration. Learn more on page 8.

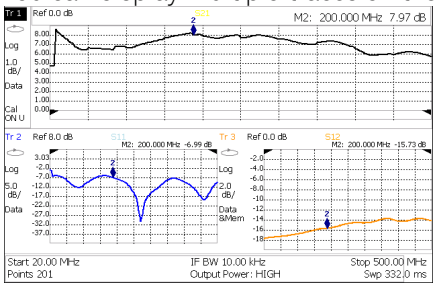
3. Press **Freq/Dist** then either **Start** and **Stop** or **Center** and **Freq Span** to enter a frequency range for the measurement.
4. Press **BW 2** then **IF BW** to select the IF Bandwidth for the measurement. Narrower bandwidths require more time to sweep.
5. Press **Sweep 3** then **Resolution** to select the number of data points for the measurement. More data points requires more time to sweep.
6. Press **Cal 5** to calibrate the measurement. See page 9 to learn more.

Continued on following page...

The following NA Mode settings can be made **before** or **after** calibrating without affecting measurement accuracy.

- Press **Scale/Amptd** to change scale.
  - **Autoscale** Adjusts the Y-axis to comfortably fit the Min and Max amplitude of the active trace.
  - **Autoscale All** Autoscales all of the traces on the screen. Useful for multi-trace configurations.
  - **Scale** Manually enter a **scale per division** to view specific areas of the trace.
  - **Ref Level** Manually set the value of the reference line.
  - **Ref Pos** Manually set the position of the reference line. Values must be between 0 (TOP line) and 10 (BOTTOM line)
- Press **Measure 1** then **Format** to change the format for the measurement.
- Press **BW 2** then **Average** then enter a value for the number of trace sweeps to average.
- Press **Marker** then enter a value to move the marker to the X-axis position of interest.
- Press **Limit 8** then **Edit Limits** or **Recall Limits** to test measurement results against limit lines.

You can display multiple traces on the FieldFox screen.



The above image shows a 3-trace configuration. Tr1 is the ACTIVE trace as indicated by the highlighted **Tr1** annotation in the upper left corner.

The Frequency Range, IF BW, Resolution, Averaging, and Output power is common to all traces. All trace settings, such as format, markers, and limit lines, are applied to the ACTIVE trace in the same manner as when a single trace is present.

To select a multi-trace configuration:

- Press **Trace 6** then **Num of Traces**
- Then choose a multi-trace configuration.

To activate a trace in order to change a setting:

- Use the **▲|▼** arrows to scroll through the traces - OR
- Press **Trace 6** then select **Trace 1**, **Trace 2**, **Trace 3**, or **Trace 4**, Only traces that are shown can be activated.

By default with Multi-trace configurations, Markers that are applied to one trace are applied to ALL traces.

Calibration (CAT, NA, VVM)

Calibration is performed in CAT, NA, and VVM Modes.
A calibration is performed automatically when the FieldFox is powered ON, CalReady sets the reference plane at the test port connectors.
For highest accuracy, perform a QuickCal or O,S,L when any of the following occur:

- The temperature changes significantly.
- The Frequency Range, Resolution, Min Swp Time, or Power Level is changed.
- When using a phase stable jumper cable or adapter to connect the DUT to the FieldFox. These should be high-quality components.

Press **Cal 5** then follow the prompts.
During a QuickCal[1], press **Skip Load** when NOT using a jumper cable or adapter.
Cal Rdy is shown on the screen when a **CalReady** is correcting the measurement.
Cal ON Q is shown on the screen when a **QuickCal** is correcting the measurement.
CAL ON U is shown on the screen when an **O,S,L** Cal is correcting the measurement.
When a calibration is being interpolated, an asterisk is added to the screen annotation as follows: **Cal ON***

[1] QuickCal does not apply to N995xA/6xA models.

Spectrum Analyzer (SA Mode)

SA measurements require NO calibration.

Check for a Compressed Measurement

1. Using a marker at the signal peak, make note of the signal power level.
2. Increase the RF Attenuation level by 5 dB.

- If the signal level does NOT change, then NO compression exists. This indicates that the signal is in the linear region of the receiver.
- If the signal level DOES increase with more attenuation, then compression DID exist. Set the RF Attenuation value at the setting when further increases no longer result in an increase in the displayed power level.

Set RF Attenuation

1. Press **Preset** then **Preset**
2. Press **Mode** then **SA**
3. Press **Scale/Amptd** then **RF Atten**

- **Auto** RF Attenuation is set by adjusting the Ref Level.
- **Man** Change the RF Attenuation level manually.

Display up to four types of traces

SA settings are applied to all traces.

1. Press **Trace 6** then **Trace 1,2,3,4** repeatedly to select a trace number to display.
2. Then **State** to select a trace type.

Optionally apply a Radio Standard which changes frequency settings, Res BW, and other relevant settings to that of the selected standard. Then change the frequency range by selecting channel numbers.

1. Press **Freq/Dist** then **More** then **Radio Standard**. Scroll to select the standard.
2. Then press **Back**.
3. Then press **Unit Freq Chan**.
4. If active, press **Chan Direction** to toggle between **Uplink** and **Downlink** frequencies.
5. Optionally, change the **Channel Step** size which allows you to use the **▲|▼** arrows to increment the channel number by the specified value.
6. Then **Back** and **Center**, **Start**, or **Stop** channel.
7. Press **Measure 1** then **Channel Measurements** and choose from the following:

- Channel Power (CHP) - Measures total power over the specified Integrated BW.
- Occupied Bandwidth (OBW) - Measures the power of the current frequency span and displays vertical posts between which the specified percentage of power is contained.
- Adjacent Channel Power (ACPR) - Measures the power of a carrier channel and one, two, or three adjacent (offset) channels.
- Tune and Listen (AM/FM) – Plays potentially interfering AM or FM signals through the FieldFox speaker or headphones.

Record Playback (Opt 236)

Allows you to record SA traces and play them back at a later time. You are allowed to change most SA settings during a recording. Setting changes are recorded along with the traces.

To record a new session:

Press **Trace 6** then **Record Playback**
Then **New Session**, **Recorder Player**, then **Record**
Optionally set the following **Recording Configuration**:

- **Record Time** – limits record time.
- **Record Source** – choose where in the FieldFox data flow that data is recorded. RawMeas is easiest.
- **Record Interval** – sets the amount of time to wait between individual trace recordings.
- **Segment Count** – sets the number of traces to record.
- **FreqMaskTrigger** – sets the power level which will trigger a recording.

To play a session:
Press **Recall Session** select a session, press **Open**. Then **Recorder Player** then **Play**.
Run/Hold can be used to Pause and Resume during Record or Playback.
The maximum recording time is determined largely by the amount of available memory. To maximize recording time, select **Storage Device** then **Internal** or **USB** (flash drive) or **SD Card**.

Power Meter measurements are made using a **Keysight USB Power Sensor.**
For a complete list of supported Keysight USB Power Sensors, visit:
www.keysight.com/find/usbsensorsforfieldfox
Damage levels are:

- +25 dBm (320 mW) average
- +33 dBm peak (2 W) <10µs
- +5V

Use an Attenuator between the DUT and the power sensor when measuring power levels that are higher than +20 dBm. The attenuator value can be subtracted from the measurement using Offset as follows:
Select Offset

- Press **Scale / Amptd** then **Offset On Off**
- Then **Offset Val** Enter a value by which the power meter display is offset. A positive value compensates for a component with loss, such as an attenuator.

Zeroing
The Keysight USB Power Sensors perform internal zeroing automatically. Internal zeroing does NOT require that the power source be turned OFF.
Perform external zeroing when measuring power levels below -30 dBm. During external zeroing, the power source MUST either be turned OFF or the power sensor be disconnected from the DUT.

- Press **Cal 5**
- Then **External Zero**

Save current settings and calibration, trace data (CSV) and .S1P), or a picture of the FieldFox screen.

Press **Save/Recall 9**

1. Then **Device** to set the LOCATION where the file is to be saved. Choose from the following:
   - **Internal** Saves/Recalls files to or from the FieldFox internal memory.
   - **SD Card** Saves/Recalls files to or from the mini SD card.
   - **USB** Saves/Recalls files to or from a USB Flash drive.
2. Then **File Type**
   - **State** Saves ALL FieldFox instrument settings and calibration for ALL Modes to an *.sta file.
   - **Trace + State** Saves the current trace (all traces in SA mode) and instrument settings to an *.sta file.
   - **Picture (PNG)** Saves the FieldFox screen to a *.png file.
   - **Data (S1P)** Saves CAT and NA Mode trace data to an *.S1P file.
   - **Data (CSV)** Saves trace data from the current mode to a *.csv file.
3. Then press **Save** to save the specified file type to the specified device location.
4. Press **Recall** to read an *.sta file into the FieldFox.

This information is subject to change without notice.

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Edition 4 Print Date: January 2016

Supersedes: September 2, 2015

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