Keysight ENA Series Network Analyzers

Amplifier Measurement Wizard Operation Manual

Rev. 01.41

October 2014

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Sample Program

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Overview of the program

The ENA Amplifier Measurement Wizard VBA macro assists setting measurement conditions for amplifier tests..

Program Description

Program title	Amplifier Measurement Wizard
VBA File Name	EnaAmplifierWizard_0141.vba
Revision	Rev.01.41

Supported ENA models and firmware

Models	**Firmware**
E5071C 2-port/4-port	Rev.8.00 or later

Required external instruments

- Power meter and power sensor (for harmonics and gain compression measurement)

Measurements supported in the Wizard

- S-parameter measurements
- Harmonic measurements (ENA Opt 008 FOM is required)
- Gain compression measurements (CW / Swept)

Starting VBA Program

Step1. Copy VBA file to local drive of ENA.

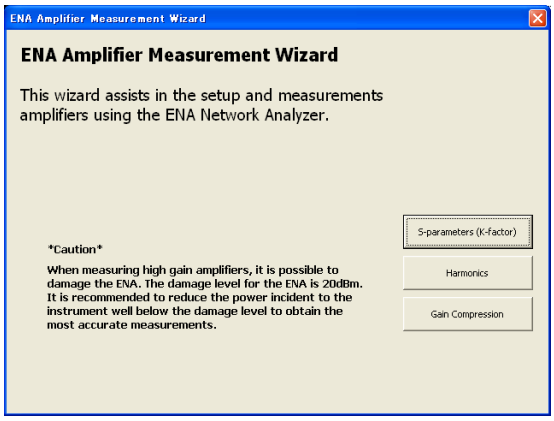
Step2. Press Macro Setup on the front panel.

Step3. Press **Load Project** and load VBA file.

Step4. Press Macro Run on the front panel.

VBA Procedure: Startup Dialogue

The VBA starts with following dialogue.



The measurement type can be selected with this dialog. The procedure of the wizard and measurement result for each measurement type is described below.

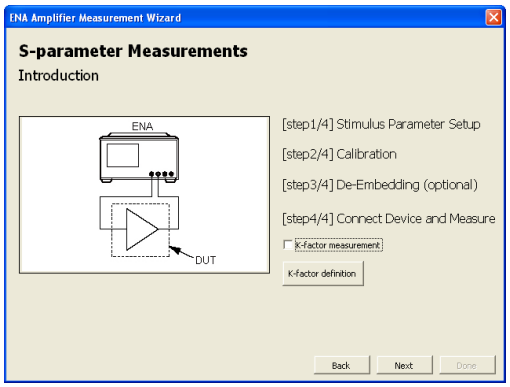
(Note: If the measurement wizard dialogue gets behind the ENA application during the operation, press [Focus] hard key on ENA.)

VBA Procedure: S-parameter Measurements

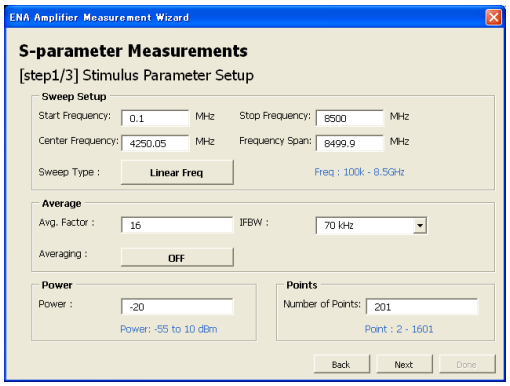
Introduction

If you check “K-factor-measurement” check box, you can measure the K-factor as well as the S-parameters.

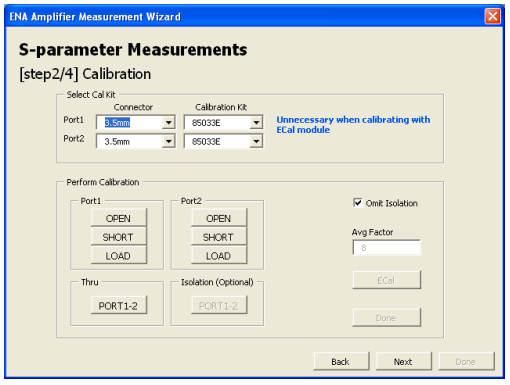
By pressing the “K-factor definition” button, the definition of the K-factor is displayed.



[step1/4] Stimulus Parameter Setup

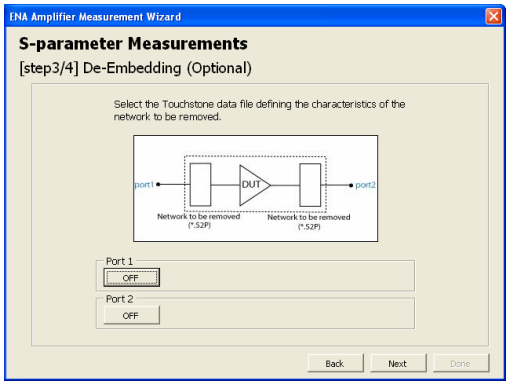


[step2/4] Calibration

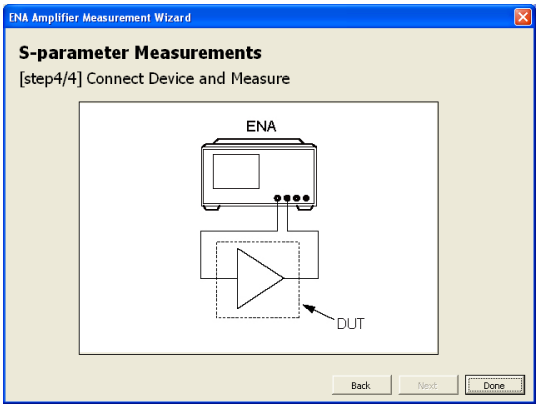


[step3/4] De-Embedding

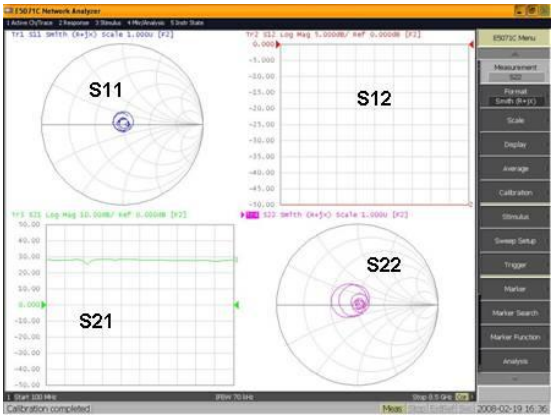
If there is an unwanted network between the DUT and the calibration plane, you can remove it with de-embedding feature. The touchstone file (*.s2p) should be prepared beforehand. If you don’t need to do this, just press the “Next” button.



[step3/4] Connect Device and Measure

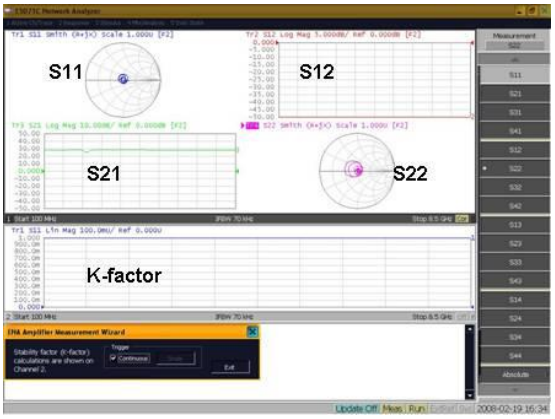


Measurement result (Without K-factor)



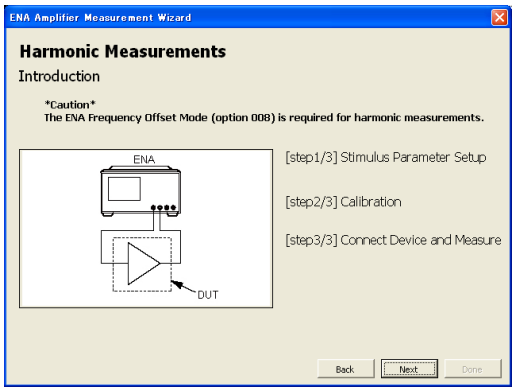
Measurement result (With K-factor)

The K-factor measurement is performed every time after the sweep. The K-factor is drawn on the Ch2 by the VBA.



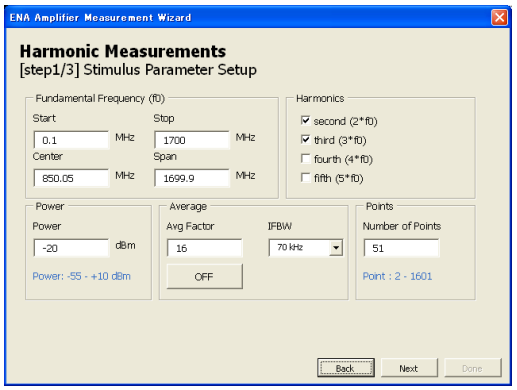
VBA Procedure: Harmonics Measurements

Introduction



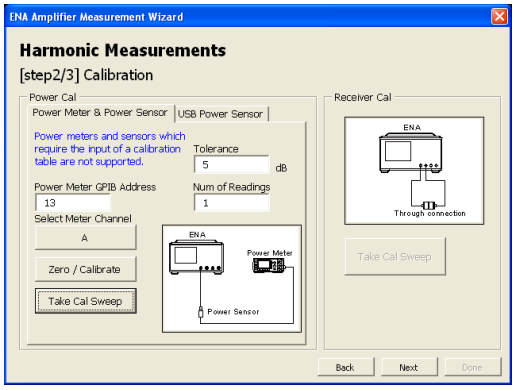
[step1/3] Stimulus Parameter Setup

The harmonics of the fundamental frequency can be set on this step. If the frequency for the measurement is not enough, the checkbox for the harmonics is disabled automatically.

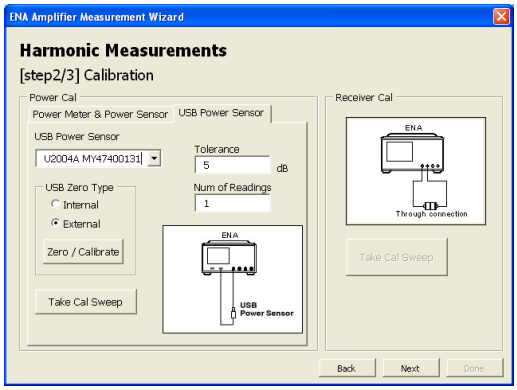


[step2/3] Calibration

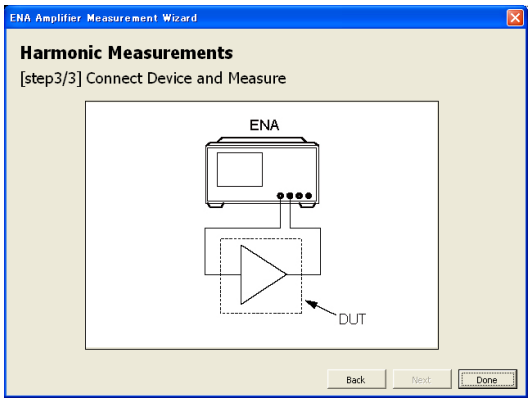
On harmonics measurement, the power calibration and the receiver calibration is required for the accurate measurement.
As for the power calibration, you can choose either of “Power Meter & Power Sensor” or “USB Power Sensor”.



The “Receiver Calibration” button is activated after the power calibration is performed.



[step3/3] Connect Device and Measure



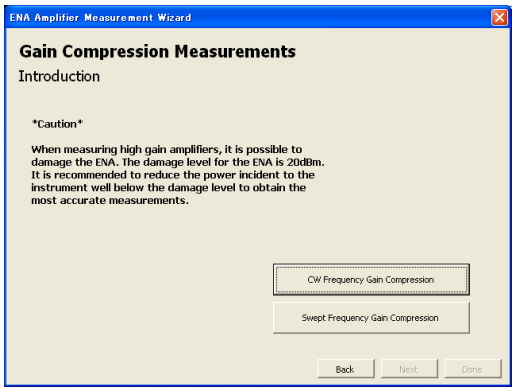
Measurement result

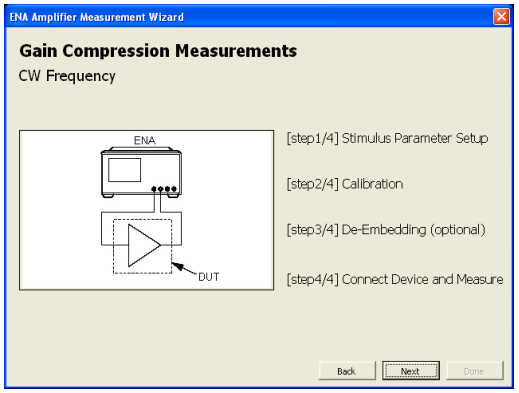
On the ch1, absolute power [dBm] of fundamental frequency is displayed. Also, the VBA draws the absolute power [dBm] of each harmonics frequency on the Ch2-Ch5. On the Ch6, the VBA overlays the harmonics value compared to the fundamental power [dBc].

VBA Procedure: Compression Measurements (CW)

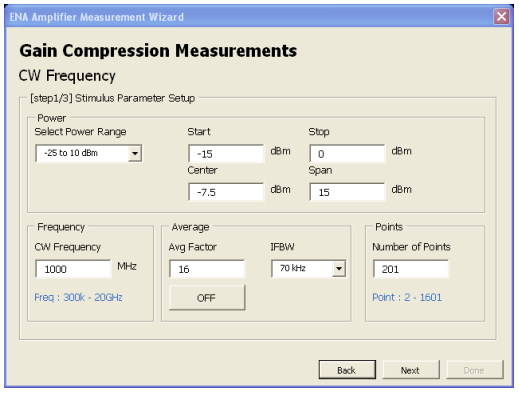
Introduction

First off, you need to select CW frequency on this step. On the CW frequency, the ENA performs power sweep on single frequency, then calculate the P1dB.





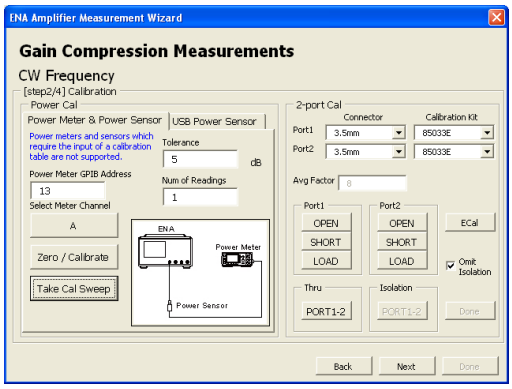
[step1/4] Stimulus parameter setup



[step2/4] Calibration

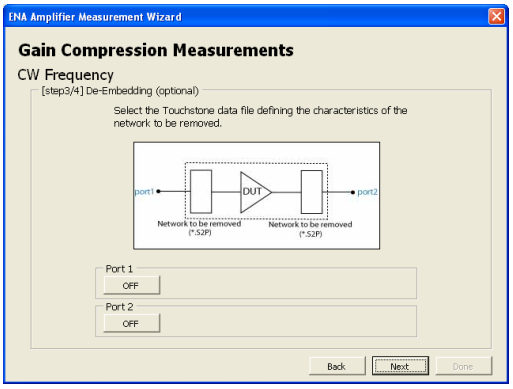
On P1dB measurement, the power calibration and the full-2port calibration is required for the accurate measurement.

As for the power calibration, you can choose either of “Power Meter & Power Sensor” or “USB Power Sensor”.

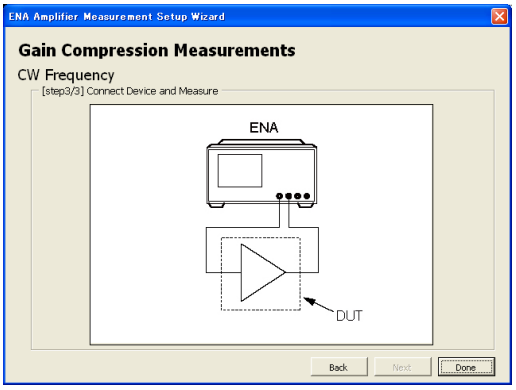


[step3/4] De-Embedding

If there is an unwanted network between the DUT and the calibration plane, you can remove it with de-embedding feature. The touchstone file (*.s2p) should be prepared beforehand. If you don't need to do this, just press the "Next" button.



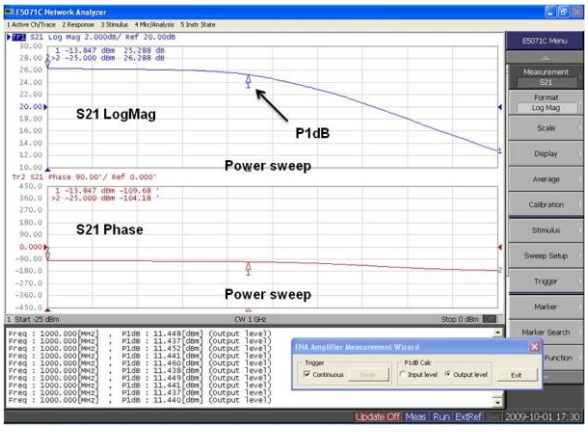
[step4/4] Connect Device and measure



Measurement result

You can choose either of "input level" or "output level" for the P1dB calculation. The input level simply shows the input power for the DUT (source power of the ENA) where the P1dB compression occurs. If you select the output level, it shows output power where the P1dB compression occurs.

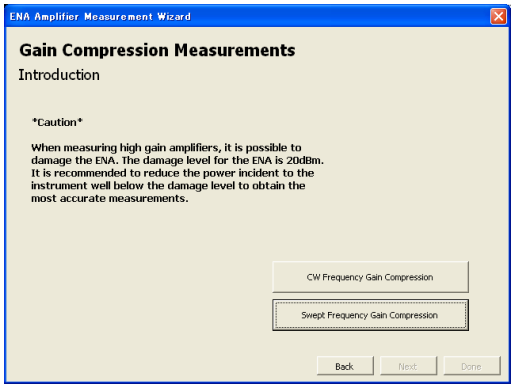
Note that the P1dB calculation uses marker on the Tr1, and the Tr1 should be activated when the VBA calculates the P1dB. If you change the active trace to Tr2, the VBA does not work properly.



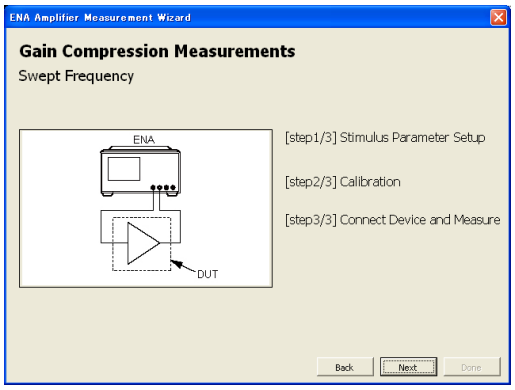
VBA Procedure: Compression Measurements (Swept frequency)

Introduction

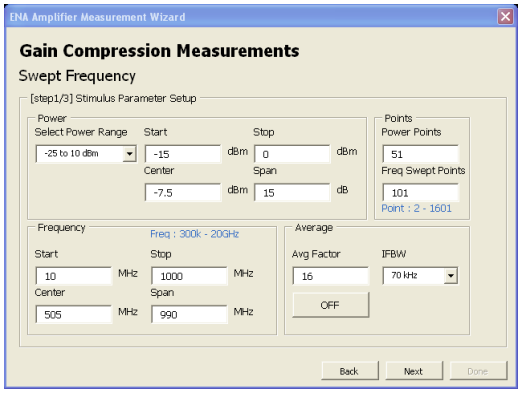
You need to select Swept frequency on this step.
On the Swept frequency, the ENA performs power sweep on single frequency for each frequency point, then calculates the P1dB for each frequency, and then plots the frequency dependency of the P1dB.



Introduction (Swept Frequency)

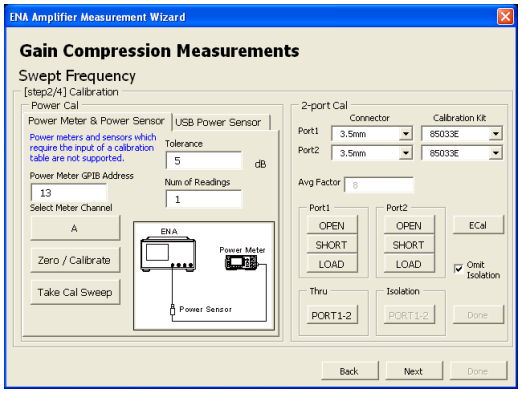


[step1/4] Stimulus parameter setup



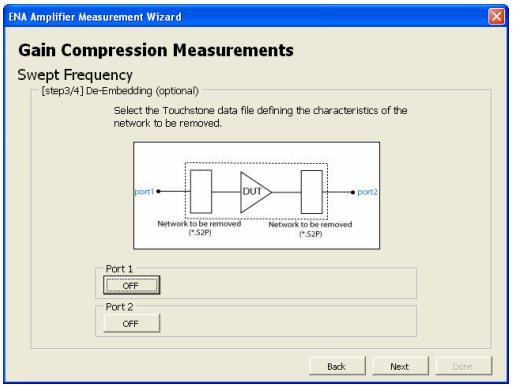
[step2/4] Calibration

On P1dB measurement, the power calibration and the full-2port calibration is required for the accurate measurement.
As for the power calibration, you can choose either of “Power Meter & Power Sensor” or “USB Power Sensor”.

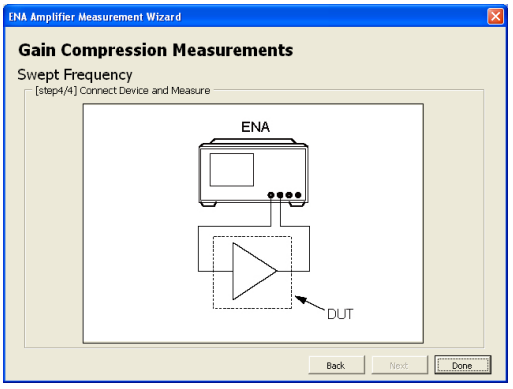


[step3/4] De-Embedding

If there is an unwanted network between the DUT and the calibration plane, you can remove it with de-embedding feature. The touchstone file (*.s2p) should be prepared beforehand. If you don't need to do this, just press the "Next" button.

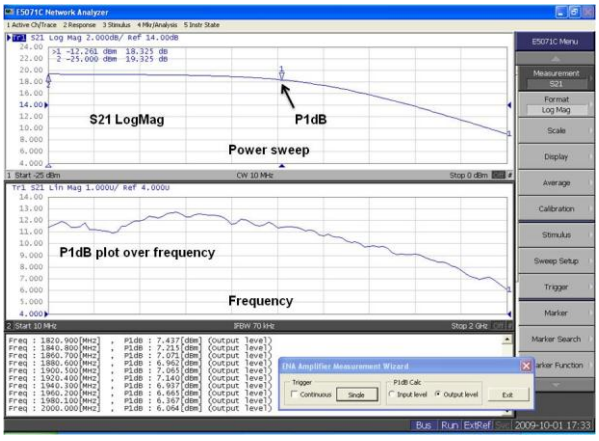


[step4/4] Connect Device and measure



Measurement result

The Ch1 shows the power sweep for single frequency. The VBA program performs P1dB search on this measurement. On the Ch2, the VBA plots the "input level [dBm]" or "output level [dBm] of the P1dB over the frequency. Same as the CW mode, the input level simply shows the input power for the DUT (source power of the ENA) where the P1dB compression occurs. If you select the output level, it shows output power where the P1dB compression occurs.



Revision History

Revision	Date	Description
01.00	Mar 2008	Initial revision
01.01	Apr 2008	Modified frequency range check function
01.10	Oct 2008	Added 20GHz Option support
01.11	Mar 2009	Revised the image of the K-factor definition
01.20	Oct 2009	Added following features: - USB power sensor for power calibration - De-embedding wizard - P1dB power calculation on either input absolute power or output absolute power
01.30	July 2010	Added option TDR support
01.40	Jan 2011	Added the calibration kits: (85038A/F/M, 85054D, 85056D, 85056K, 85039B)
01.41	Oct 2014	Minor bug fix to support Windows 7