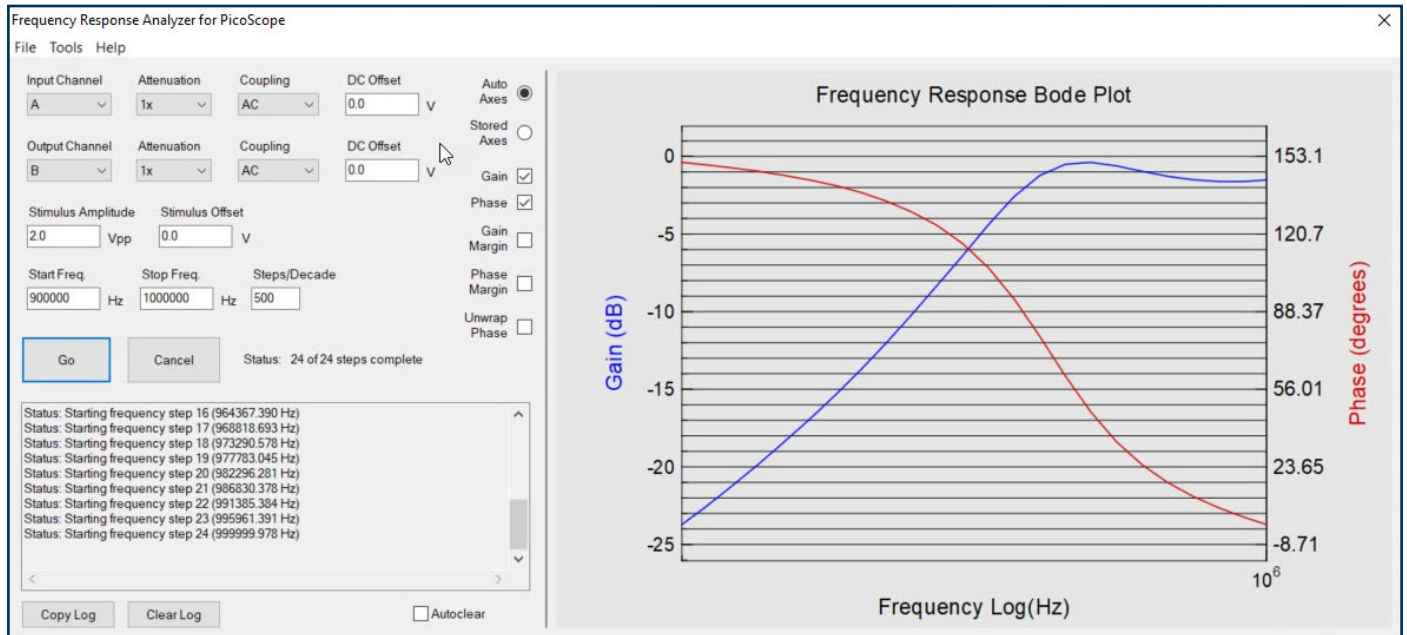


Application Note



FRA4PicoScope



Introduction

This is a guide to installing and using FRA4PicoScope, the frequency response analyzer (FRA) created by Aaron Hexamer, a member of the Pico Technology Test & Measurement Forum. The FRA is available to download free of charge. It requires at least two analog channels plus a built-in function generator and works with most PicoScope instruments on a Windows PC.

An FRA is often an expensive high-precision measurement instrument. It is used to analyze components, circuits and systems (known as devices under test, or DUTs) in the frequency domain.

Some typical applications include:

- Filter characterization
- Filter design
- Control loop stability analysis
- Audio amplifier design
- Transformer performance evaluation, particularly for signals

An FRA typically generates a sinusoidal signal and injects it into a DUT. This signal is measured at the point of injection using one of the input channels on the FRA, usually Channel 1. The injection signal travels through the DUT and the FRA measures the same signal simultaneously at a second reference point—normally the output of the system—using Channel 2. The use of sinewaves allows the frequency domain behavior (the frequency response) of a system to be determined.

PicoScope instruments are particularly suitable for frequency response analysis: nearly all of our real-time oscilloscopes have a built-in function generator. The addition of this FRA application, which will operate with your choice of computer, makes for a very compact design compared to many standalone FRAs. Many will be familiar with the PicoScope software available for free download from our website. If you are an existing PicoScope owner then you can also use the FRA Software.

Installing the FRA application

Step 1: installing PicoSDK®

In order for the FRA software to run correctly, you will first need to install our software development kit, PicoSDK. To do this, visit the [Downloads page](#) on our website, and select your oscilloscope series and model from the lists.

Click **Software**, and download the 32-bit version of PicoSDK for Windows.

0 items

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Home / Downloads

Download software and manuals for oscilloscopes and data loggers

From this page you can download the latest version PicoScope oscilloscope software, PicoLog data logging software, software development kits (SDK), brochures and manuals. If you do not own a Pico product you can download the software for the product you are interested in and run in demo mode.

Product series	PicoScope 2000 Series	PicoScope 2204A	Software
PicoScope 2000 Series	PicoScope 2204A	Software	
PicoScope 3000 Series	PicoScope 2205A	Manuals & brochures	
PicoScope 4000 Series	PicoScope 2205A MSO		
PicoScope 5000 Series	PicoScope 2206B		
PicoScope 6000 Series	PicoScope 2206B MSO		
PicoScope 9000 Series	PicoScope 2207B		
PicoLog Data Loggers	PicoScope 2207B MSO		
PicoSource	PicoScope 2208B		
PicoVNA	PicoScope 2208B MSO		
Discontinued products	PicoScope 2405A		

Resource	Release type	Size	Released
Windows:			
PicoScope 6.14.23	Stable	201 MB	May 22 2020
PicoLog 6.1.16	Stable	164 MB	May 18 2020
PicoSDK 10.6.13 (32-bit)	Stable	77 MB	May 16 2019
PicoSDK 10.6.13 (64-bit)	Stable	80 MB	May 16 2019
Mac:			
PicoScope 6.14.23 including drivers	Beta	294 MB	May 22 2020
PicoLog 6.1.16	Stable	106 MB	May 18 2020

Step 2: find the FRA forum topic

Go to the [Pico Technology Test & Measurement Forum](#), where users of Pico products can meet to ask and answer questions and share their applications.

Test & Measurement Forum

Pico Technical Support and Discussion Forum

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It is currently Thu Jun 04, 2020 9:24 pm

NEW TO PICO	TOPICS	POSTS	LAST POST
Introductions Come here to introduce yourself, who you are, and what you do	193	498	Re: PicoScope 2000 CAN featur... by bennog Mon May 25, 2020 12:25 pm
Pre-Sales Advice Which product is right for your exact requirements	1162	3438	Re: Using a Picoscope as SPI/... by guifajin Mon Jun 01, 2020 1:05 pm
Getting Started Having problems ? let us know the details here	808	2885	Error in resistance measureme... by Alex_EP Thu May 28, 2020 6:11 am

PROJECTS AND APPLICATIONS	TOPICS	POSTS	LAST POST
Projects Post discussions on projects you are working on	61	168	Re: 5444D - Increasing delay ... by potizakus Thu Jun 04, 2020 5:59 pm
Applications Post discussions on applications you are writing	33	565	Re: Simultaneously trigger ac... by victorm Fri May 29, 2020 9:10 am

Scroll down the page to **Projects and Applications**, and click **Applications**.

You will see the screen below. Select **Frequency Response Analyzer with Bode Plots**.

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33 topics • Page 1 of 1

ANNOUNCEMENTS	REPLIES	VIEWS	LAST POST
Generating and Acquiring Signals in LabVIEW in 2208B by Anbarasan.10 » Thu Mar 12, 2020 1:32 pm » in Getting Started	1	3335	by AndrewA Fri Mar 20, 2020 4:41 pm
How to detect the Current Probe Programatically through labview in pico 3000 series scope by RBEI » Fri Aug 23, 2019 6:35 am » in LabVIEW	2	3284	by ramyasri123 Mon Mar 16, 2020 9:25 am

TOPICS	REPLIES	VIEWS	LAST POST
Simultaneously trigger acquisition and generator by victorm » Tue May 05, 2020 1:30 pm	5	1616	by victorm Fri May 29, 2020 9:10 am
Frequency Response Analyzer with Bode Plots by hexamer » Sat Aug 16, 2014 5:02 am	478	211454	by mnni Wed May 27, 2020 6:14 pm
PS4824 Delphi Sample by Taborda » Wed Oct 10, 2018 10:38 am	2	1721	by JohannesH Wed Apr 29, 2020 6:58 am
Scope 2208A as counting module	0	1407	by PhotonCoder

Step 3: download the app

You are now in the section of our forum that covers the frequency response analyzer.

In the very first post, you will see the link to Aaron Hexamer's Bitbucket page, where you can find out more about the application and download it free of charge – click the link.

Test & Measurement Forum

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Frequency Response Analyzer with Bode Plots

[Post Reply](#)

479 posts 1 2 3 4 5 ... 32

Frequency Response Analyzer with Bode Plots

by **hexamer** » Sat Aug 16, 2014 5:02 am

Hello All,

Based on a need I had for a good Frequency Response Analysis tool for PicoScope, I started to develop one. Initially it was just for my PS5444A, but I decided to go ahead and make it general purpose since I had seen several posts on here asking for this. Unfortunately I don't have any other scopes to do any testing on, so I'd really love some help. I'd consider it in "beta" status for now, but I've tested it with my scope on Windows XP (SP3), Vista, and 7. Right now it's only got built in support for the PS2000A, PS4000, and PS5000A families, but adding more scopes is pretty trivial.

If anyone is interested, I'm hosting it here: <https://bitbucket.org/hexamer/fra4picoscope/wiki/Home>

Binaries are available if you're not into building the code yourself.

Hope it's usefull

Aaron.

hexamer
Advanced User
Posts: 0
Joined: Tue Aug 12, 2014 10:09 pm

Re: Frequency Response Analyzer with Bode Plots

by **JimClarke** » Tue Sep 09, 2014 1:45 pm

JimClarke
Newbie
Posts: 0

Select **Downloads** from the menu on the left, then click the most recent installation (*.msi) file in the list. Remember that you will also require the 32-bit version of PicoSDK, as advised in Step 1 above.

C++ FRA4PicoScope

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Aaron Hexamer / Untitled project / FRA4PicoScope

Downloads

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Name	Size	Uploaded by	Downloads	Date
Download repository	3.2 MB			
FRA4PicoScope_0.7.0b_RC1.msi	5.6 MB	Aaron Hexamer	155	2020-04-04
FRA4PicoScope 0.6.2b.msi	5.6 MB	Aaron Hexamer	783	2019-06-16
FRA4PicoScope 0.6.2b PS4262 Test.msi	5.6 MB	Aaron Hexamer	144	2018-10-21
plplot_install_debug.zip	1.5 MB	Aaron Hexamer	172	2018-08-16
plplot_install_release.zip	1.0 MB	Aaron Hexamer	281	2018-08-16
qtlibs.zip	45.8 MB	Aaron Hexamer	248	2018-08-16
FRA4PicoScope 0.6.1.msi	5.6 MB	Aaron Hexamer	1278	2017-07-16
Debug FRA4PicoScope 0.6.msi	5.6 MB	Aaron Hexamer	231	2017-04-23
FRA4PicoScope 0.6b.msi	5.6 MB	Aaron Hexamer	331	2017-03-24
FRA4PicoScopeAPI.zip	5.2 MB	Aaron Hexamer	445	2016-11-13

Using the FRA application: analyzing a 1 MHz highpass filter

Hardware setup

The setup pictured uses a PicoScope 5444D MSO, which is the high-end model in the flexible resolution (FlexRes®) PicoScope 5000 Series, with 200 MHz bandwidth, four analog channels and 16 digital inputs. The FRA application only requires two channels, however, and there is a wide range of suitable models in the PicoScope 2000, 3000, 4000 and 5000 Series. The PicoScope 6000 Series oscilloscopes will be compatible with the FRA app at a future date: contact our Technical Support team for more information.



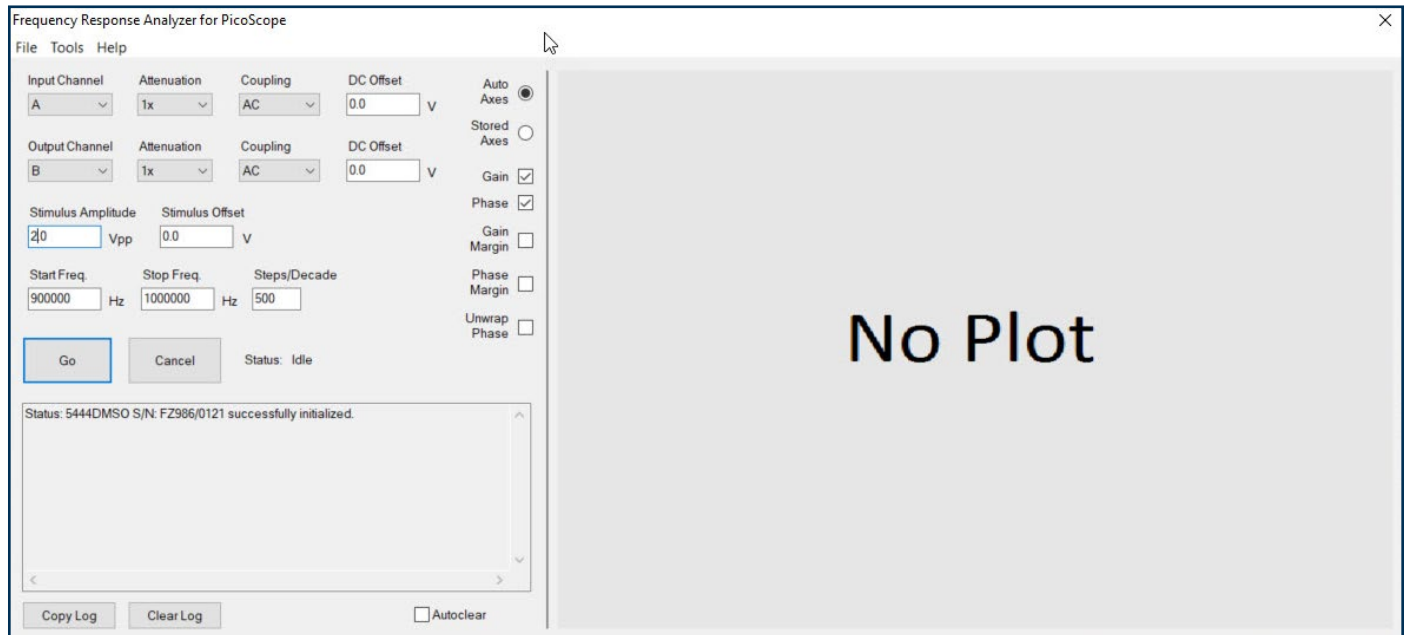
For an FRA to function it requires an input signal, typically sinusoidal. Here, a BNC splitter has been attached to the oscilloscope function generator output, with cables connecting it to the input of the highpass filter (HPF) and to Channel A of the oscilloscope. Another cable connects the HPF output to oscilloscope Channel B of the oscilloscope.

FRA software setup

The first time the application is run, it will search for an available oscilloscope device. If only one scope is connected to the PC, it will automatically use that one; otherwise it will ask you to select a device. From that point forward, the application will remember the most recently used scope and automatically open it on startup. To change the scope device, open the **File** menu and select **Connect Device**.

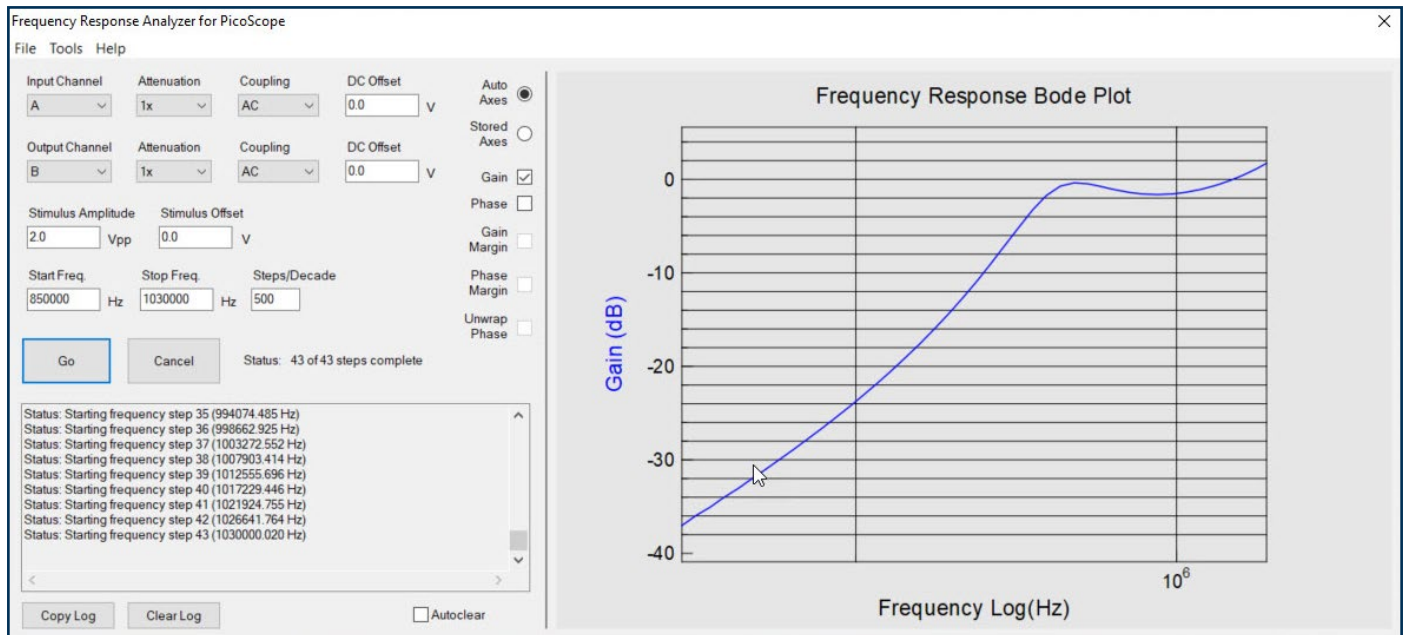
The first time a scope is opened, default FRA settings are provided each time a new scope is connected. Change these as appropriate. Once settings are entered and the circuit to be measured is connected, click **Go** to begin the execution. If you need to stop for any reason, click **Cancel**. Once the FRA execution is completed, you can export the plot image or raw data from the File menu.

Here you can see that the FRA has successfully connected to the PicoScope 5444D MSO, and that start and stop frequencies have been entered to analyze a 1 MHz highpass filter.

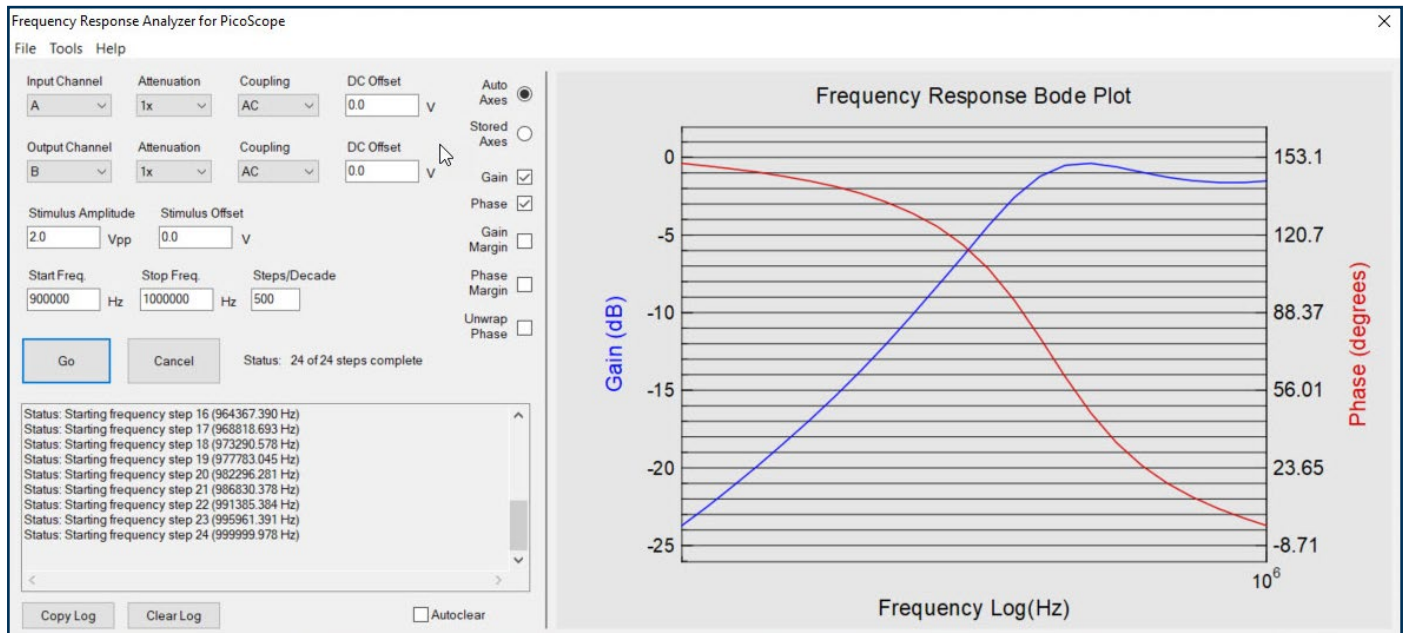


Analysis of the 1 MHz highpass filter

This image is an initial plot, showing only the gain, in order to reference the pass frequency of the filter.

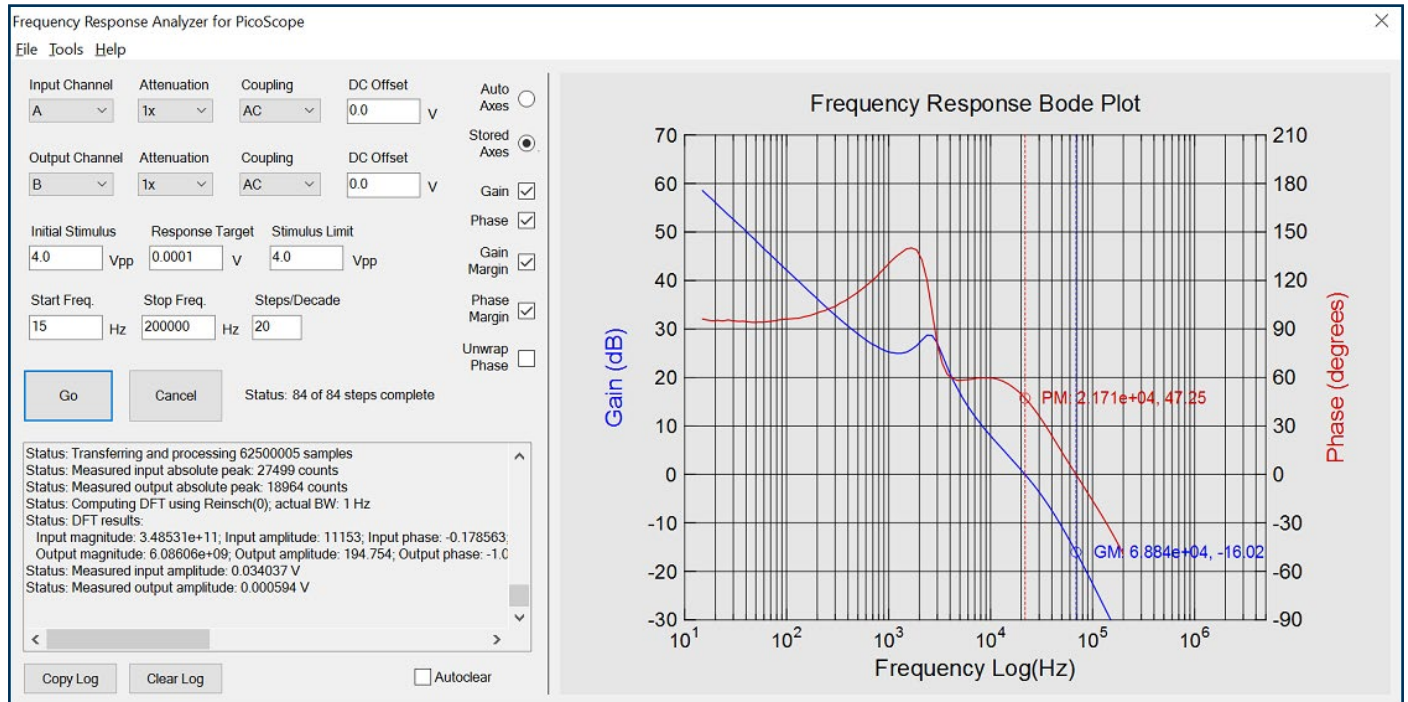


The image below shows the full frequency response Bode plot.

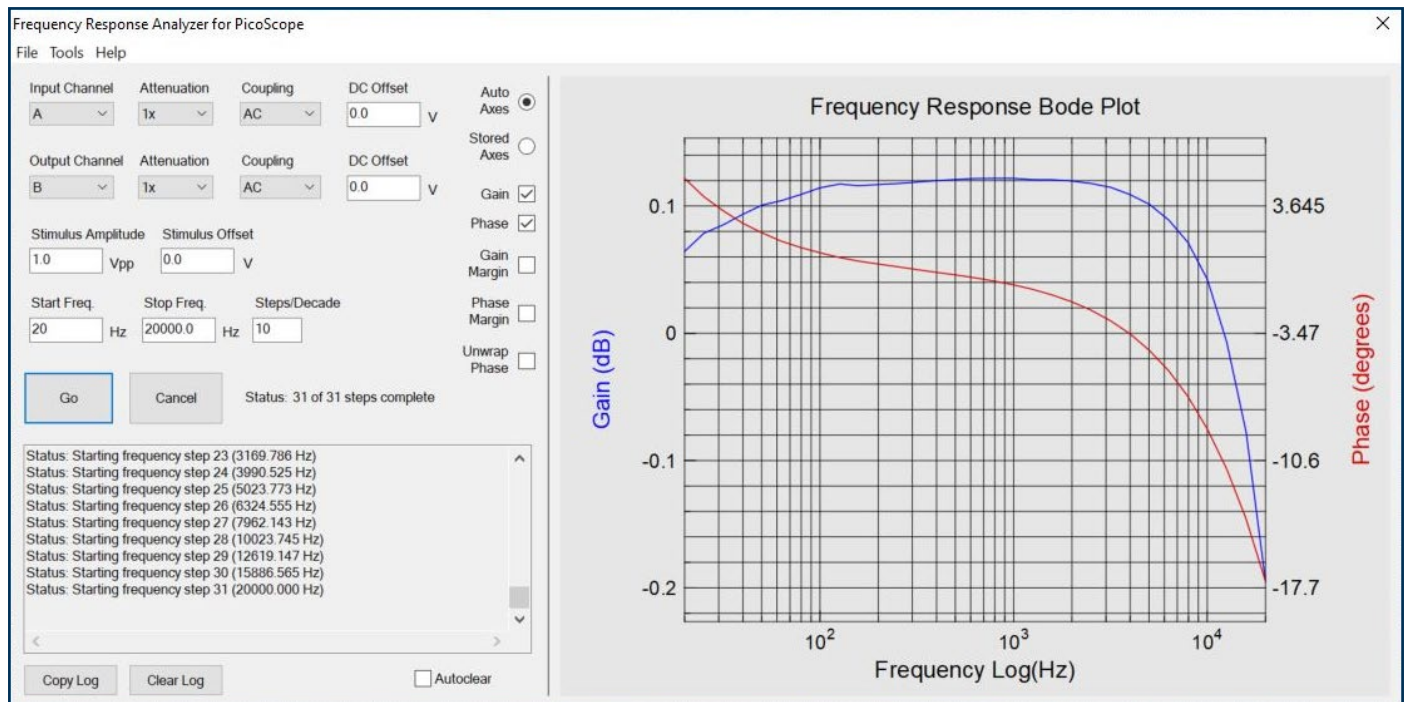


Further examples shared by customers using the FRA application

Here you can see a customer example measuring switched mode power supply stability.



Below is a customer example of an audio amplifier.



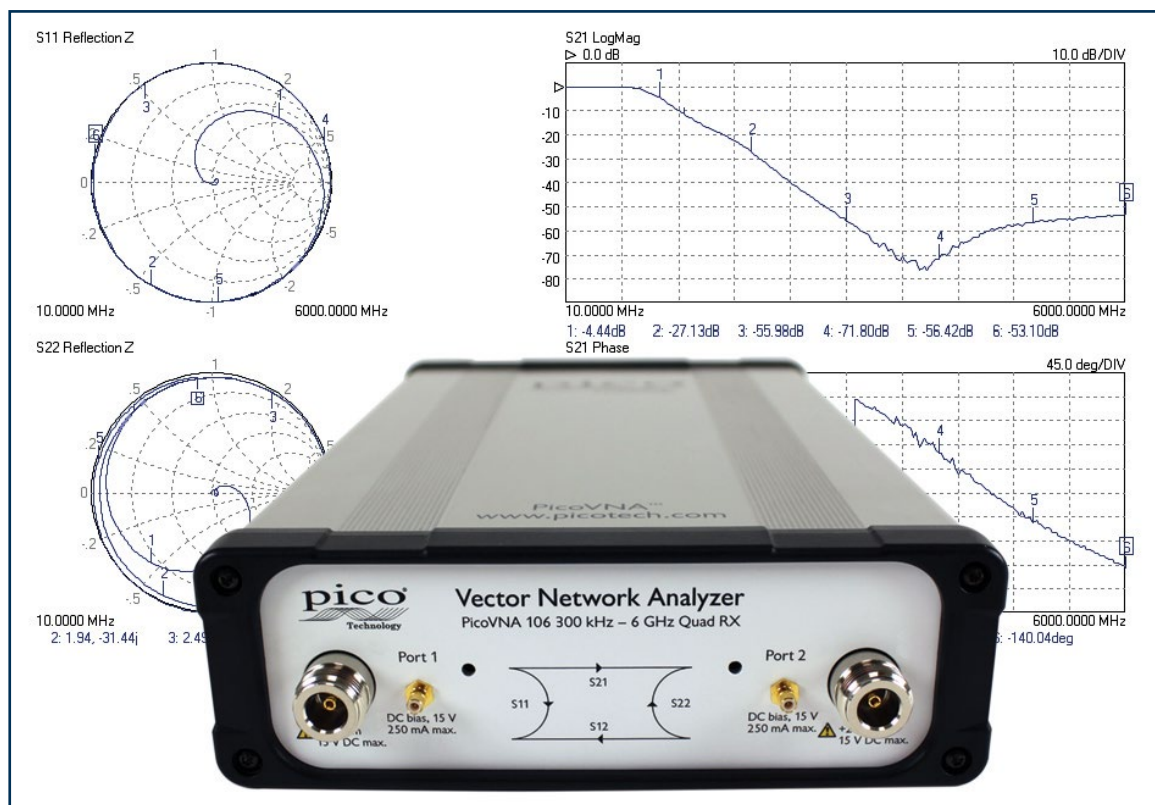
Vector network analysis

For vector network analysis applications, consider the PicoVNA® 106 6 GHz Vector Network Analyzer.

The PicoVNA 106's portability, light weight and low cost suit it to field service, installation test, OEM embedded and classroom applications. With its remote automation capability, it is also attractive in applications such as:

- Test automation, including multiple VNA control and measurement
- Integrating a reflectometry or transmission measurement core during manufacture
- Inspection, test, characterization and calibration in the manufacture, distribution and service center industries
- Electronics component, assembly and systems, and interface/interconnect ATE (cable, PCB and wireless)
- Material, geological, life-science and food sciences; tissue imaging; penetrating scan and radar
- Broadband cable and harness test and matching, at manufacture and installation, and fault-over-life monitoring
- Antenna matching and tuning

Drivers are supplied as part of the main software download, and programming examples in MATLAB (using the MATLAB RF toolbox), National Instruments LabVIEW, C# and Python are all available for download from Pico Technology's [GitHub organization page](#). Examples include multiple-instrument addressing and control.



[Click here to find out more about the PicoVNA-106.](#)

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