RF Education Kit Solution

SOLUTIONS

SO2406-A0013EN01

SIGLENT TECHNOLOGIES CO.,LTD

Trademark Information

SIGLENT is a registered trademark of SIGLENT TECHNOLOGY CO., LTD.

Statement

· Our products are protected by approved and pending patents of the People's Republic of China

· Our company reserves the right to change specifications and prices

· The information provided in this manual supersedes all previously published materials

· The contents of this manual may not be copied, excerpted, or translated in any form or by any means without the consent of our company

Product Certification

SIGLENT certifies that this product complies with China's national product standards and industry product standards, and further certifies that this product complies with the relevant standards of other members of international standards organizations.

Contact Us

Service Hotline: 400-878-0807

E-mail: support@siglent.com

Website: https://www.siglent.com

1 Overview

The fundamental principle of radio frequency (RF) technology is electromagnetic theory. It is the process of generating RF signals through an oscillator, propagating electromagnetic waves via an antenna, and decoding the signals at the receiving end through a demodulator to restore the original information. It is widely used in fields such as communications, aerospace, medical, and life sciences. For beginners in the RF field, the first thing to understand is the behavior of RF signals in the frequency domain and the characteristics of some common RF components. However, RF knowledge is often abstract and difficult to grasp, necessitating a complete set of experimental equipment to verify various knowledge points.

2 Challenge

It is widely known that RF products are generally expensive. Configuring a complete set of RF transmission and test equipment represents a significant investment. An affordable, easy-to-use, and fully functional RF learning kit is very helpful in promoting RF knowledge.

3 Solution

For beginners in the RF field, the first step is to learn and observe the behavior of RF signals in the frequency domain, understanding the differences between theoretical and actual signals. Additionally, it is necessary to learn about common RF circuit modules, such as amplifiers and mixers, and understand the impact these modules have on signals.

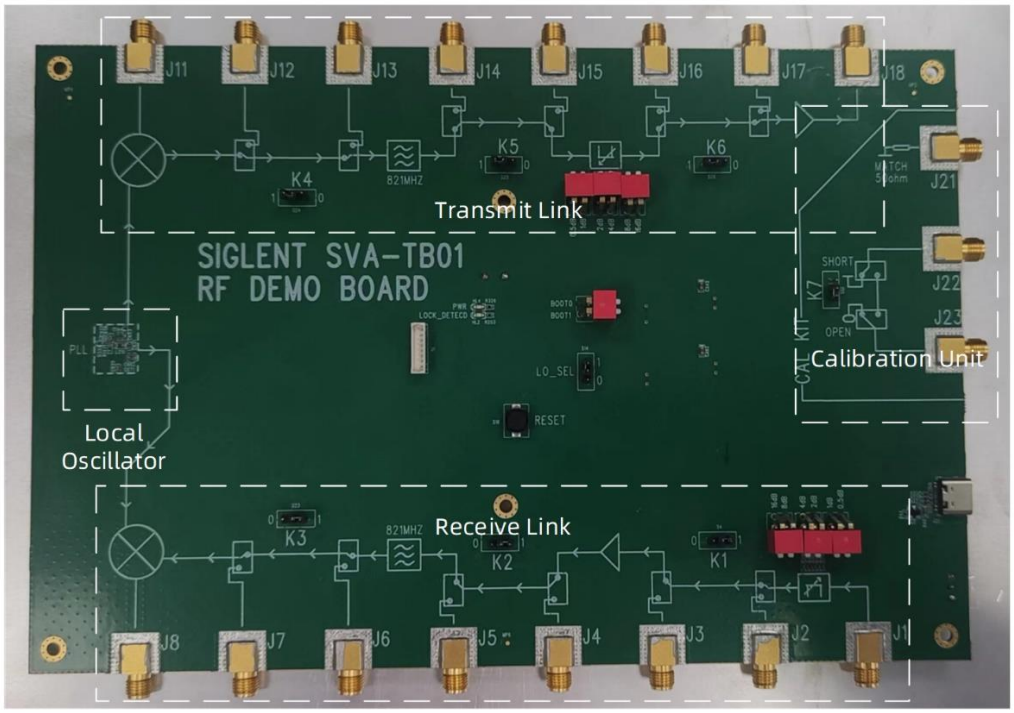

Figure 1: SVA-TB01 RF Experiment Teaching Board

To address the learning needs of beginners regarding RF modules, SIGLENT has launched the SVA-TB01 RF Experiment Teaching Board. It contains various common RF circuit modules, effectively aiding in learning RF knowledge and exploring related experiments. The entire teaching board consists of a complete transmit link (composed of an attenuator, amplifier, filter, and mixer), a receive link (composed of a mixer, filter, attenuator, and amplifier), a calibration unit (open circuit, short circuit, matched load), a local oscillator unit, and a power supply module. Each component in the transmission and reception chains can be independently or jointly tested via external interfaces, allowing for separate testing of each device. This helps students understand and learn the functions and characteristics of RF circuit modules. Testing these modules typically involves pairing them with an RF source and a spectrum analyzer or vector network analyzer to help observe signals, providing a more intuitive understanding of the impact various common modules have on RF signals.

3.1 Understanding the Behavior of RF Signals in the Frequency Domain

For beginners, the first step is to observe the most basic RF signal, which is the behavior of a sine wave in the frequency domain. Through spectrum analyzer analysis, observe the impact of hardware on signal transmission and understand the differences between the actual situation and the ideal condition of signal transmission. The SVA1000X has spectrum measurement and vector network analysis capabilities, allowing it to send signals via the TG port and receive signals via the RF port.

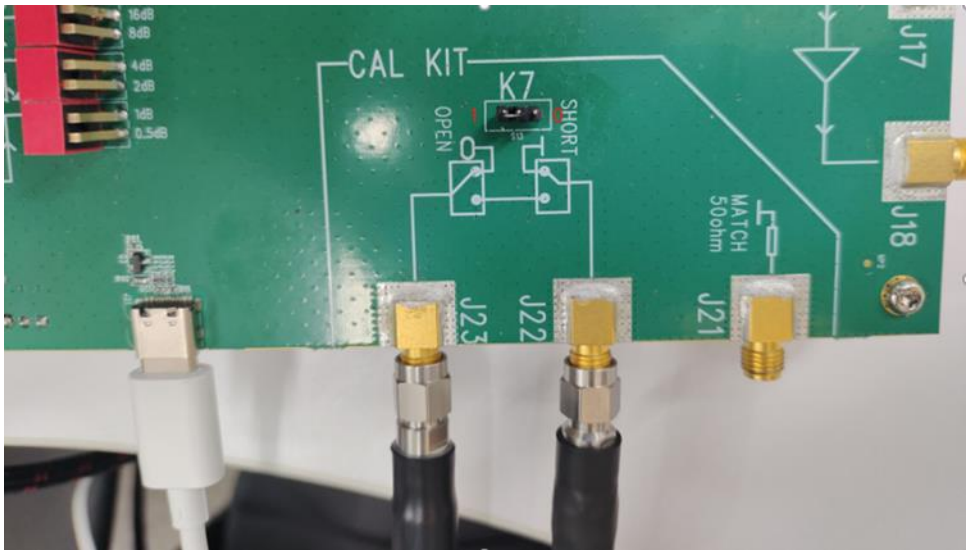

Figure 2: Testing Harmonics on the SVA-TB01 RF Experiment Teaching Board

By comparing the direct transmission of the TG signal to the RF port with the TG signal passing through the calibration unit before connecting to the RF port, one can observe the effects during actual signal transmission. Due to the inherent nonlinearity of the sine wave generating equipment itself and the additional nonlinearity introduced when the signal passes through the actual link of the teaching board, the spectrum of the actual sine wave signal observed on the spectrum analyzer has a certain bandwidth. Furthermore, we can also observe the multiple harmonics generated in the hardware system. These tests

can help beginners quickly understand the differences between ideal RF signals and actual measured RF signals.

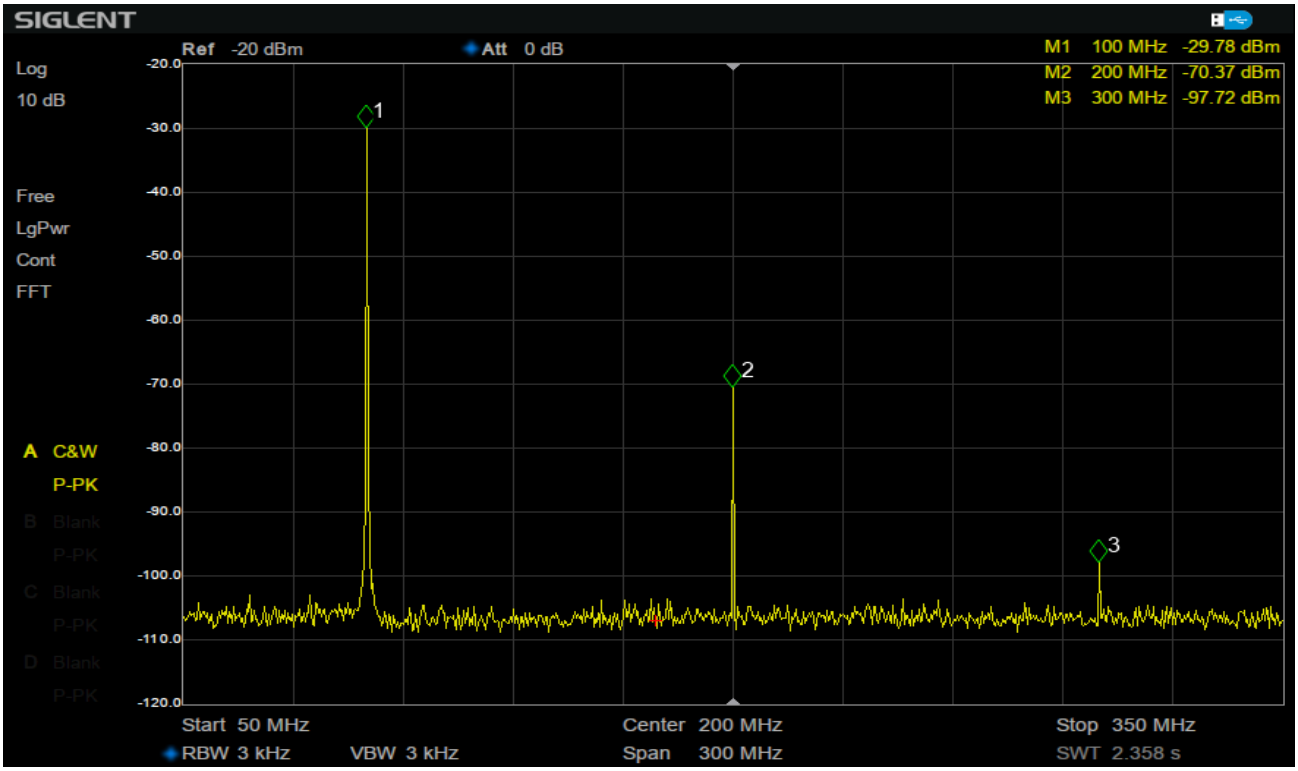

Figure 3: SVA1000X Harmonic Test Results

3.2 Understanding the Characteristics of Common RF Circuit Modules

In the RF field, besides basic signal transmission and reception, we also encounter various RF modules used for signal modulation. Common RF modules include mixers, filters, attenuators, and amplifiers. When designing RF circuits, multiple modules are often linked together to modulate and filter signals. This requires a thorough understanding of the functions of these RF modules. Traditional RF teaching modules are often only single, independent components. It is very inconvenient to combine multiple RF modules into a complete circuit. Moreover, when building the link, unfamiliarity with the modules and connection errors can introduce other noise or interference, making it difficult to observe the impact of each module on the signal clearly. The SVA-TB01 integrates these modules onto the same link and allows control of each module via switches. For beginners, this makes it more convenient to test individual modules or combine multiple modules into a circuit for testing.

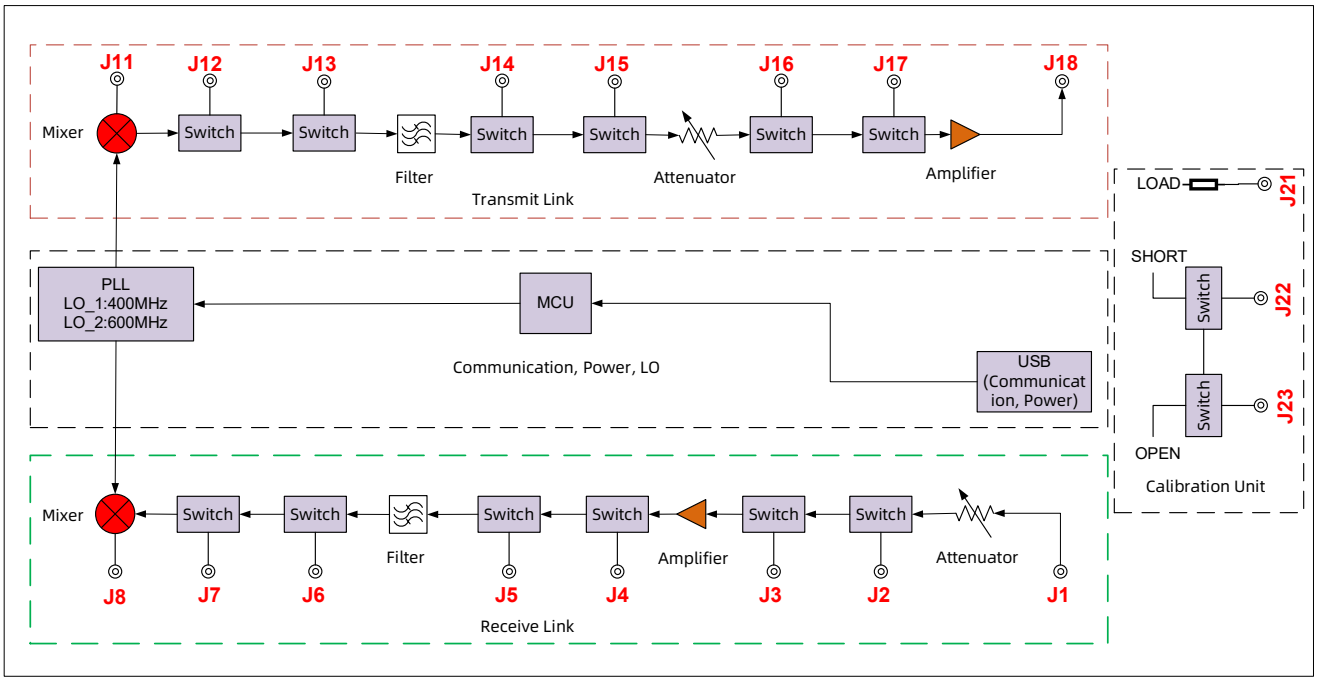

Figure 4: SVA-TB01 RF Experiment Teaching Board RF Link Structure Diagram

By pairing with an SSG3021X RF source and an SVA1000X vector network analyzer, beginners can freely choose the modules they want to test, arbitrarily combine different modules, and learn about the effects various module settings have on the signal. The two complete sets of reception and transmission chains can also be used for comparative testing, helping beginners understand the differences of modules in the reception versus transmission chains and the roles of corresponding modules in each.

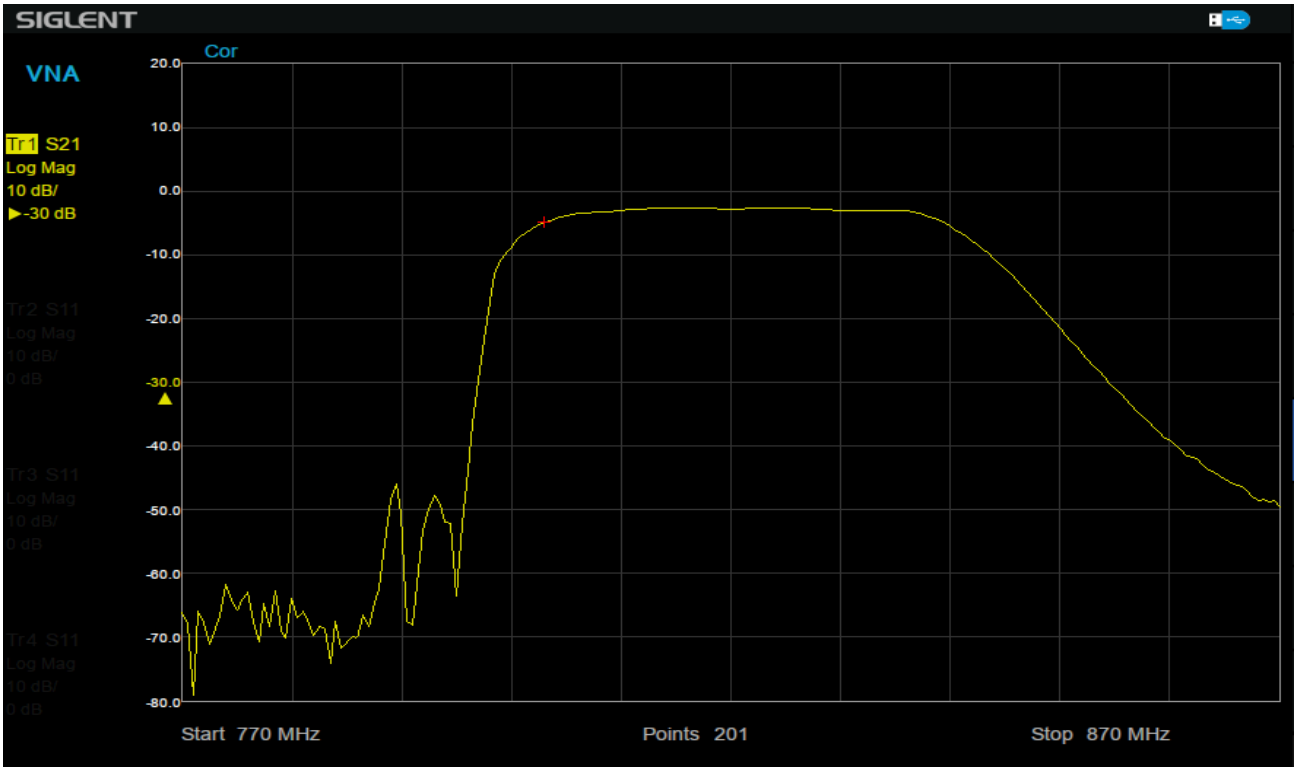

Figure 5: SVA1000X Test Results for the Filter Module

4 Summary

The SVA-TB01 RF Education Kit is equipped with various RF modules. It is fully functional and easy to operate, helping beginners quickly learn and understand RF signals and the characteristics of common RF circuit modules. It is an excellent tool for beginners to explore and learn about the RF field.

About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

Headquarters:

SIGLENT Technologies Co., Ltd

Add: Bldg No.4 & No.5, Antongda Industrial Zone, 3rd Liuxian Road, Bao'an District, Shenzhen, 518101, China

Tel: + 86 755 3688 7876

Fax: + 86 755 3359 1582

Email: sales@siglent.com

Website: int.siglent.com

North America:

SIGLENT Technologies America, Inc

6557 Cochran Rd Solon, Ohio 44139

Tel: 440-398-5800

Toll Free: 877-515-5551

Fax: 440-399-1211

Email: info@siglentna.com

Website: www.siglentna.com

Europe:

SIGLENT Technologies Germany GmbH

Add: Staetzlinger Str. 70

86165 Augsburg, Germany

Tel: +49(0)-821-666 0 111 0

Follow us on
Facebook: SiglentTech