# AT-RF3030
# RF Training System Kit

## Parts in AT-RF3030 Kit

| No. | Name | Quantity |
| --- | --- | --- |
| 1 | SMA-50Ω Terminal load | 3 |
| 2 | SMA Open circuit load | 1 |
| 3 | SMA Short circuit load | 1 |
| 4 | SMA-50JJ Connector | 5 |
| 5 | SMA-50KK-1 Connector | 3 |
| 6 | SMB-C-TKW1.5-3X300Power cables linking | 5 |
| 7 | SFF-1.5-50-1Shielding Line | 5 |
| 8 | BNC-SMAtransformer | 2 |
| 9 | Coaxial attenuator 10dB | 1 |
| 10 | Coaxial attenuator 20dB | 1 |
| 11 | Technical notes | 1 |
| 12 | Experimental reference books | 1 |



Parts in AT-RF3030 Kit

Portion AT3030 Connecting Photo

With the advent of the information age and the development of science and technology, Communication has become a national defense modernization. The indispensable part of development of national economy and people's daily life. It has extremely wide applications in the field of aerospace technology. Communication is the transmission tool of transmission of information, control instructions, test data, and other important information.

With the rapid development satellite communications mobile communications, personal communications and so on; radio frequency (RF) technology has become the Coke of concern to the people. Nurturing technicians with ability of RF theoretical and practical knowledge has also become the urgent need of common schools and the community. However, as we all know, RF technology when compared with other similar technology, there is considerable particularity and difficulty. One of the important aspects is that students must learn to accept certain practical training beside the curriculum. So they could successfully enter the door of RF technology and lay the foundation for future development.

AT-RF3030 RF Training System settings is training to enable students through increased access to the radio frequency system's basic structure, working principle, simulation analysis, test equipment and measurement skills in a rational and perceptual knowledge. Truly master the time domain and frequency domain, the transmission lines, radio wave propagation, antennas, RF modules, and radio frequency communications, and other basic concepts, and learn how to use important RF test instruments.

AT-RF3030 Training system uses Radio Frequency Modular Training for the structural design of experiments in the training provided a very simple, flexible assembly, while equipment can be integrated in a box, easy to carry and transport. The module circuit use all microstrip circuit design, have transparent plexiglass on the cover and can be clearly observed that the structure of all microstrip circuit.

RF and microwave is different with other experimental system, the Training system is mainly based on frequency-domain technology and spectrum measurement equipment. To do so the following has to be laken considerations：

1) The RF communications, sensing, signal processing and other such terms of the most important areas. Frequency domain contains many the important messages that in the time domain measurement difficult or inconvenient to find, thus use high sensitivity and wide dynamic range spectrum analyzer.

2) We can facilitate the measurement low-level AM, FM and pulse modulated RF signal, Carrier Frequency, Modulation Frequency, Modulation, Calm Modulation Distortion, also can be easily detect the frequency converter of loss, isolation and distortion characteristics.

But more important is that despite the advantages of measuring the spectrum have long recognized，However, the high prices of spectrum analyzer had make it concealed in the research departments and rare meeting with the students. But with the domestic high-cost performance of the available spectrum analyzer, ideas become into reality that spectrum analyzer series to be the main instrument of teaching experimental.

**ATTEN®**

# AT-RF3030 RF Training System
## Main Technical Specification of Each Module

**VCO**
F=1300–2350MHz、
Po≥5dBm
Adjustable Voltage:0~20V

**Matching Load**
50Ω Matching Load、
50Ω–100Ω
1/4Wavelengh Matching Load、
50Ω–100+j80Ω

**Microstrip ring**
Fo=2000MHz ± 50MHz
△F≥400MHz、
Insertion loss L≤3dB
Insertion loss I≥15dB

**Directional couplers**
Single–directional coupling
Fo=2000MHz ± 50MHz
△F≥800MHz、
C=10 ± 1dB
D≥10dB

**PINRF switching**
Use PIN DiodesF=750–2500MHz
Insertion loss L=3dB M
ay 1 election for the choice of 2

**Attenuator**
T/π type、
F：1000–2500MHz
L=10 ± 1dB

**PIN Modulator**
1KHz Square wave modulation,
Modulationm=30%~90%

**Round resonator**
Fo=2000 ± 50MHz
Insertion lossL≤7dB
△F≥30MHz

**Hybrid Ring**
Fo=2100 ± 50 Mhz
△F≥450MHz
[ ∑/△ ≥20 dB]

**Microstrip Antennas**
F=1960 ± 30MHz
G≥5dB
△F=40MHz

**Mixer**
RF/LO：F=200–3000MHz、
IF=50–1000MHz、
Loss L≤12dB（PLO≥7dBm）

**Branch coupler**
Fo=2050 ± 50 MHz
△F≥300MHz
D≥12dB

**Mismatch load**
OPEN、SHOUT、
200Ω Mismatch load

**RF Amplifiers**
F=50–3000MHz
G≥10dB
NF≤4dB

**Power Distributor**
F=0–3000MHz、
Effective bandwidth
△F=1000–3000MHz
I≥10dB

**Filter**
LPF:△F=0–2100MHz ± 50MHz
　　L≤1.5dB
BPF:Fo=1950 ± 50 Mhz
　　△F≤Fo*15%MHz
HPF:F≥1800MHz ± 50MHz
　　L≤1dB
BSF:Fo=1800 ± 50 MHz
　　△F≥600MHz [L≥25dB]
　　△F≤1500MHz [L≤3dB]

**Coaxial Detector**
F=0.5–3GHz
Sensitivity=0.15mv/mW .
Voltage standing wave ratio =1.7
Frequency response =0.6dB

**Measuring Line**
Microstrip line structure
Move distance ≥170mm
The remaining standing
wave ratio≤1.05

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# Experiments of AT-RF3030 Training System Kit

| Exp.No.  Exp.Name | Purpose of Exp. |
|---|---|
| **Exp.1**　VCO | • Be familiar with the VCO working principle and get to know their performance.<br>• Learn how to use the spectrum analyzer on the voltage-controlled oscillator to test the performance indicators. |
| **Exp.2**　Mixer | • Understanding mixer Principle and the work of the main characteristics.<br>• Be familiar with the test principle of mixer<br>• Learning how to use a Spectrum Analyzer to do the mixer test |
| **Exp.3**　Microstrip ring | • Understanding the basic principles of Microstrip ring.<br>• Understanding Microstrip ring for applications.<br>• Learning how to use the spectrum analyzer Microstrip ring for testing. |
| **Exp.4**　Directional couplers | • Grasp the basic principles and methods of directional coupler.<br>• Learn how to use spectrum analysis equipment measuring the parameters of directional coupler |
| **Exp.5**　Mismatch load | • Grasp the principles and methods of impedance matching.<br>• Learning impedance matching technology. |
| **Exp.6**　Matching Load | • Mismatch load measurement and matching load measurement methods are identical except voltage standing wave is relatively large. |
| **Exp.7**　Attenuator | • Learn how to use the spectrum analyzer measuring the various parameters of power attenuator.<br>• Understanding attenuator structural features, design method of attenuator |
| **Exp.8**　Power Distributor | • Understanding the structure principle and of frequency characteristics power distributor.<br>• Grasp test theory of power splitter Distributor<br>• Learn to how use the spectrum analyzer for the testing of power Distributor. |
| **Exp.9**　Hybrid Ring | • Understanding the structure theory, frequency characteristics of hybrid ring<br>• Grasp methods of measuring parameter of Hybird Ring<br>• Befamiliar with the inter-relationship between the various ports and Hybrid ring |
| **Exp.10**　PINRF Switching | • Understanding the basic principles of PIN Switch<br>• understanding  the use of PIN Switch |
| **Exp.11**　PIN Modulator | • Grasp the AM, FM Principle<br>• Understanding AM and FM circuit |
| **Exp.12**　Filter<br>　　　　（LPF.HPF.BPF.BSF） | • Understand the different types of filters and its spectral characteristics.<br>• Grasp filter test principle.<br>• Learn how to use Spectrum Analyzer to finish the filters test.<br>• Learn how to use the spectrum analyzer to get the results of the main parameters from filter test. |
| **Exp.13**　Round resonator | • Curve of round resonator's output level and frequency<br>• Resonance frequency, insertion loss L, bandwidth and other parameters |
| **Exp.14**　Bias Line<br>　　　　（Square Fan, Butterfly） | • Bias Line, apply to RF power supply system, and its essence is a band stop filter.<br>• This design, the notch frequency = 500 MHz Notch loss L = 20 dB insertion loss of less than 1 dB L, it's testing methods is the same with the filter testing methods. |
| **Exp.15**　Branch coupler | • Grasp branch coupler measurement method<br>• Grasp the principles branch coupler |
| **Exp.16**　RF Amplifiers | • Grasp the basic principles and design methods of RF amplifier.<br>• Experimental actual measurements using Module, understanding the characteristics of amplifier.<br>• Learn how to use the spectrum analyzer to get the test results of main amplifier parameters. |
| **Exp.17**　Microstrip Antennas | • Understanding the basic concepts of antenna, understanding the function of the RF Communications antenna system and constitute part of the modules.<br>• Learn how to use the spectrum analyzer measuring the frequency characteristics of the antenna.<br>• Learn how to use the spectrum analyzer measuring the antenna gain and direction angle |
| **Exp.18**　Measuring Line | • Understanding the basic characteristics of transmission lines and microstrip lines<br>• Familiar with the RF3030 Training system's basic structure and function<br>• Using experimental module actual measurement the characteristic of microstrip lines |
| **Exp.19**　Coaxial Detector | • Compared with the modulation, in-depth understanding the basic principles of demodulation process.<br>• Measure the detector module with AM detector characteristics.<br>• Grasp extraction and display technology of baseband signal. |
| **Exp.20**　RF front-end<br>　　　　transmit / receiver | • Understanding RF transmission / receiver basic component<br>• Using spectrum analyzer measuring the main technical indicators of RF send / receiver<br>• Measure the sensitivity of RF receiver front-end. |