User's Guide

АКИП-9506
MW Circuit Experimental System

Suin Instruments Co., Ltd 07/2024

General Introduction

The АКИП-9506 MW Circuit Experimental System is an experimental system which carries out image and audio microwave wireless transmission based on 2.4GHz transceiver system, it is equipped with microwave transceiver system circuit modules, and test instruments, including but not limited to spectrum analyzer, microwave signal generator, universal frequency counter and so on. By using these microwave circuit modules and test instruments configured with this system, users could assemble microwave transceiver system, make audio and video microwave wireless transmission, carry out microwave communication experiments, and improve their experimental ability. This experimental system can be used as experiment training system to carry out special experiment courses in high college who set up application electronic technology, communication engineering, microwave technology, microwave (electronic) measurement, electronic information and so on. This system provides a "Microwave circuit experimental system experiments guideline" which combines theory and practice, guiding users to carry out microwave communication experiments.

Characteristics

1. Adopting microwave signal frequency-2.4 GHz.
2. Six carrier frequencies available to select by channel selector, channel spacing is 8 MHz, and no interference between these channels.
3. High Frequency Stability PLL Oscillator is used as Local Oscillator Source
4. Adopting advanced circuits and microwave components.
5. Adopting independent modules easy for circuit assembly and testing
6. Each circuit module reserves the test port.
7. Communication ports are also reserved to connect with test instruments in this system, easy to carry out test.
8. Microwave circuit module components available to be provided for course designing and graduation designing requirement (Customized is accepted).
9. Related test instruments available to be provided, including but not limited to spectrum analyzer, microwave signal generator, universal frequency counter, etc.
10. "Microwave circuit experimental system experiments guideline" available to be provided.

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SD3201T Transmission system experiment box	1
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Power Cord	2

Content

1. Devices of АКИП-9506 MW Circuit Experimental System

1.1 SD3201T Transmission system(See Fig.1)

Fig.1 SD3201T Transmission system

a) Connection Schematic Diagram of SD3201T Transmission system (See Fig.2)

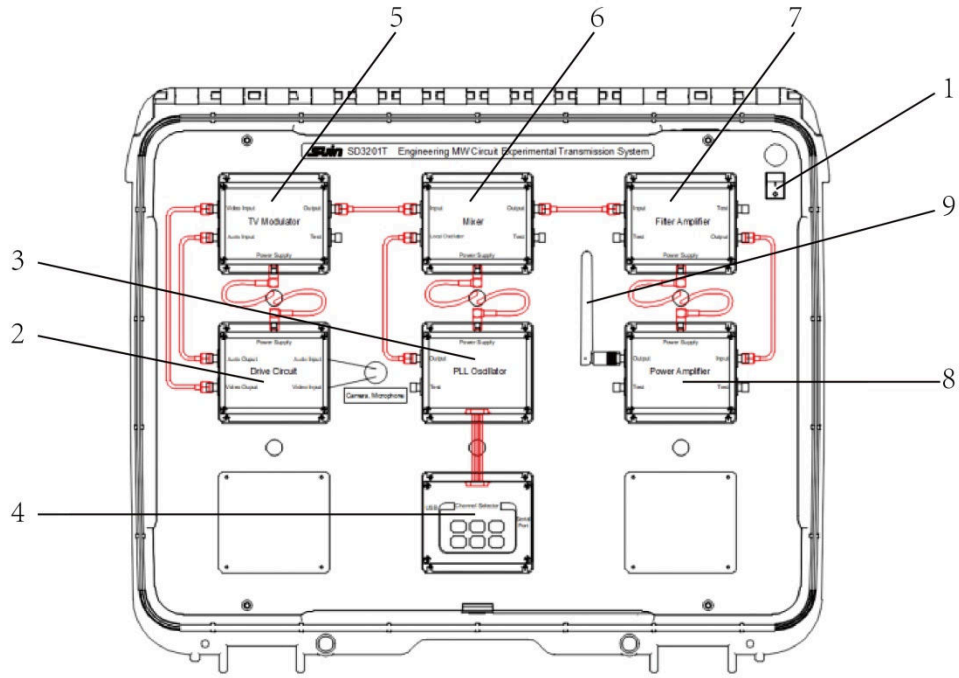

Fig.2 Connection Schematic Diagram of SD3201T Transmission system

1) Power Switch

Press the switch to make the transmission system connected to the power, the red LED indicator besides the switch will be on, indicating the system has been power on.

2) Drive Circuit

It can amplify the video signal captured by the camera, and send it to next grade for modulation.

3) PLL Oscillator

High stability PLL oscillator is adopted as the local oscillator, whose local frequency is shown as Table 1.

Table 1

Transmit Channel	CH1	CH2	CH3	CH4	CH5	CH6
Transmit Frequency	2468MHz	2476MHz	2484MHz	2492MHz	2500MHz	2508MHz
LO Frequency	2383MHz	2391MHz	2399MHz	2407MHz	2415MHz	2423MHz

4) Channel Selector

It is used to select transmit channel, control six channels; it actually controls the frequency of the local oscillator. During the transmit-receive experiment, it should keep in correspondence with the selection of receiving system's channel selector.

5) TV Modulator

It's used to modulate image signal and audio signal, AM for image signal while FM for audio signal. The output modulated carrier frequency of the modulator is 85MHz.

6) Mixer

Convert the output modulated carrier frequency of the modulator, 85MHz signal, to modulated microwave signal.

7) Filter Amplifier

Amplify the modulated microwave signal output from the mixer, the amplified signal is used to drive power amplifier.

8) Power Amplifier

Amplify the power of microwave signal to specified power in order to meet the experiment's requirement.

9) Transmitting Antenna

It is used to wirelessly transmit signal.

b) SD3201T Transmission system composition diagram(See Fig.3)

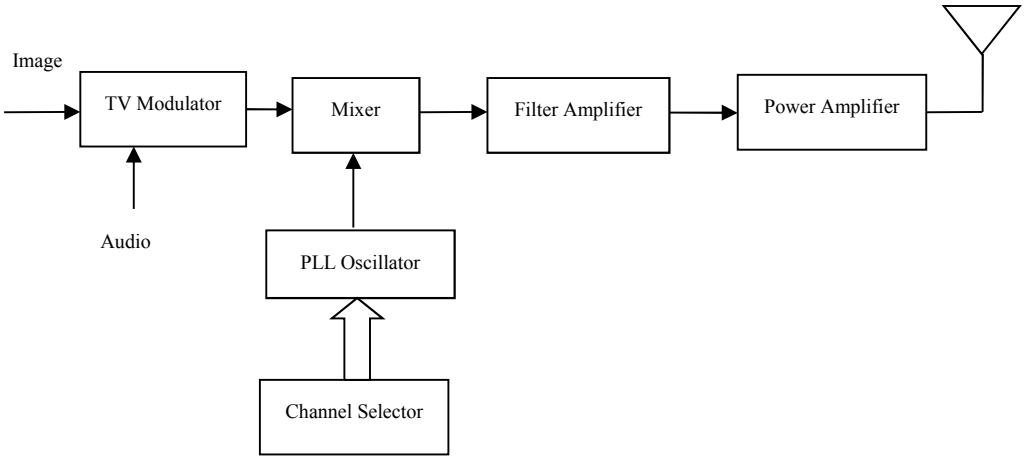

Fig.3 SD3201T Transmission system composition diagram

1.2 SD3201R Receiving System (See Fig.4)

Fig.4 SD3201R Receiving System

a) Connection of SD3201R Receiving System(See Fig.5)

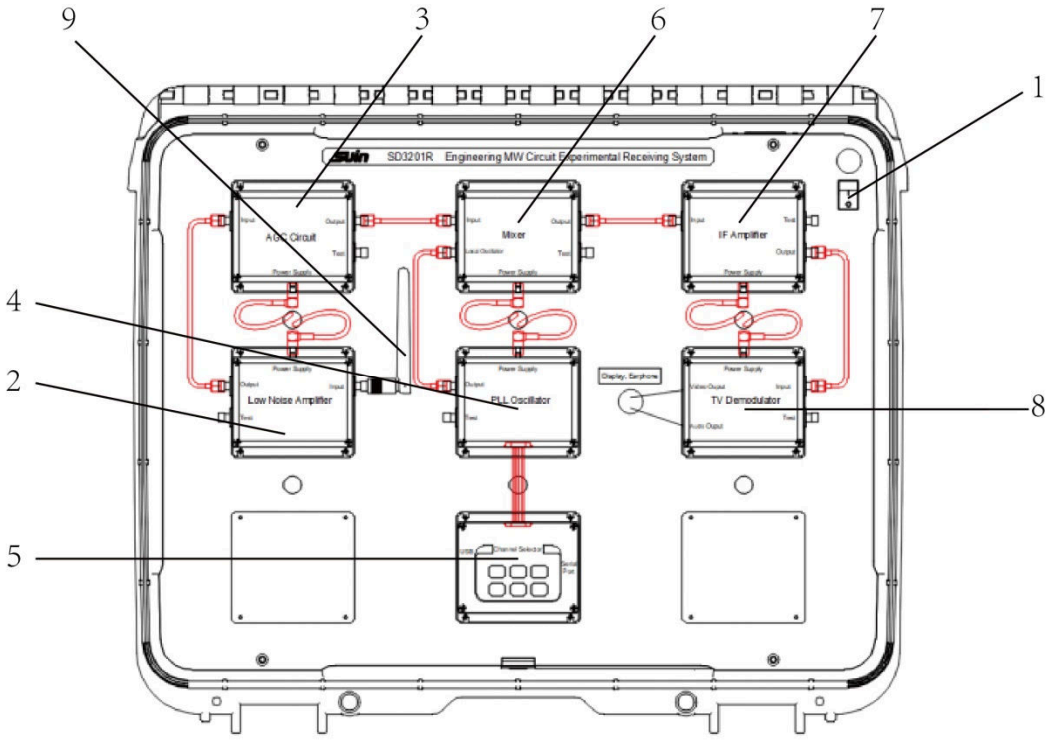

Fig.5 Connection Schematic Diagram of SD3201R Receiving System

1) Power Switch

Press the switch to make the receiving system connected to the power, the red LED indicator besides the switch will be on, indicating the system has been power on.

2) Low Noise Amplifier

Perform low noise amplification on the wireless signal received by the antenna.

3) Automatic Gain Control Circuit

It will automatically adjust the gain according to the receiving signal's strength, to ensure the signal transmit stably.

4) PLL Oscillator

It uses high stability PLL Oscillator as the local oscillator, whose local frequency is shown as Table 2.

Table 2

Receive Channel	CH1	CH2	CH3	CH4	CH5	CH6
Receive Frequency	2468MHz	2476MHz	2484MHz	2492MHz	2500MHz	2508MHz
LO Frequency	2430MHz	2438MHz	2446MHz	2454MHz	2462MHz	2470MHz

5) Channel Selector

It is used to select receiving channel, control six channels; it actually controls the frequency of the local oscillator. During the transmit-receive experiment, it should keep in correspondence with the selection of transmission system's channel selector.

6) Mixer

It's used to convert the modulated microwave signal to modulated IF 38MHz signal.

7) IF amplifier

Amplify the modulated IF 38MHz signal output by the Mixer.

8) TV Demodulator

Demodulate the modulated IF 38 MHz signal, detector detects image signal and sends it to the monitor, and discriminator detects audio signal and sends it to the speaker.

9) Receiving Antenna

It is used to wirelessly receive signal.

b) SD3201R Receiving system composition diagram(See Fig.6)

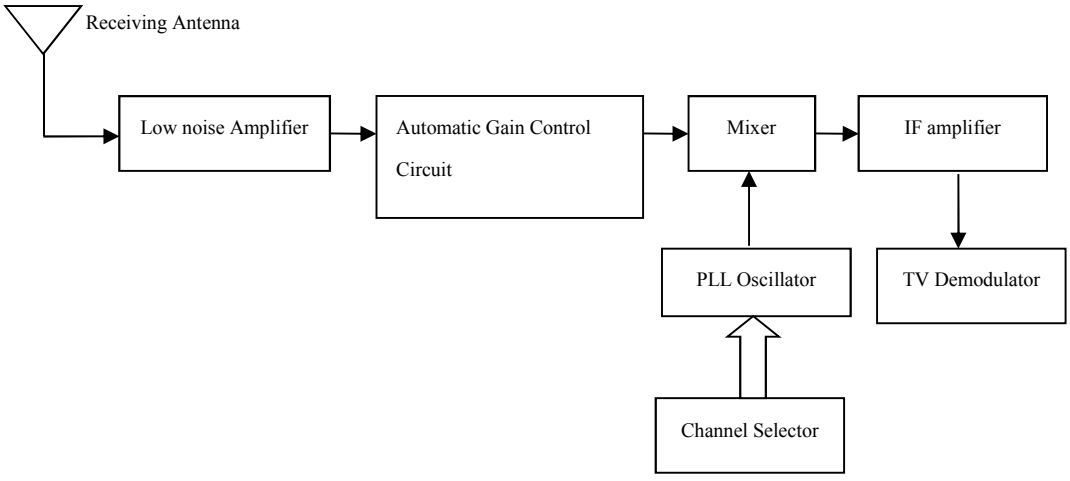

Fig.6 SD3201R Receiving system composition diagram

2. Composition of АКИП-9506 MW Circuit Experimental System

2.1 Composition of SD3201 Transceiver system

1. "SD3201T Transmission system" experiment box(composed of seven pieces microwave circuit modules)
2. "SD3201R Receiving system" experiment box(composed of seven pieces microwave circuit modules)

2.2 Main Specification of each microwave circuit module

1) TV Modulator

   Output carrier frequency: 85MHz

   Output level: approximate -10dBm

2) Up-Mixer

   RF frequency and level: 85MHz；≥-11dBm

   Local Oscillator frequency and level: (2383~2423)MHz；≥＋5dBm

   Mixer Output Frequency: (2468~2508) MHz

3) PLL Oscillator:

   Output Frequency: (2383~2470) MHz

   Output Level: -10dBm ~ +7dBm

   Output Level Adjustment Range: 20dBm

4) Filter Amplifier

   Center Frequency: 2489MHz

   Gain: approximate 10dB

5) Power Amplifier

   Frequency Range: (2468~2508) MHz

   Power Gain: ≥20dB

   1dB Compression Point $P_{1dB} \leq$ 13dBm (typ.)

6) TV Demodulator

   Input Modulated Carrier Frequency: 38MHz

   Input Amplitude: 0~5dBm

7) Low Noise Amplifier

Working Frequency Range: (2468~2508) MHz

Gain: ≥20dB

8) Automatic Gain Control Circuit

Frequency Range: (2468~ 2508) MHz

Gain: ≥20dB (at minimum attenuation)

Gain Tunable Range: 20dB

9) Down-Mixer

RF frequency and level: (2468~2508)MHz；≤-20dBm

Local Oscillator frequency and level: (2430~2470)MHz；≥+5dBm

Mixer Output Frequency: 38MHz

10) IF Amplifier

Center Frequency: 38MHz

Gain: ≥ 20 dB

2.3 Testing Instruments configured with the system

1) Spectrum Analyzer
2) Microwave Signal Generator
3) Universal Frequency Counter
4) Network Analyzer

2.4 Documents Provided

CD (User's Guide & Experiments Guideline)

3. АКИП-9506 MW Circuit Experimental System Experiment Case

3.1 АКИП-9506 Transceiver System Experiment Case (refer to Experiments Guideline)

3.2 Each module Experiment Case (refer to Experiments Guideline)

3.3 Notes in the Experiments

a) Check the internal cable connection of SD3201R/T Transceiver System

1) Whether the cable connection is damaged or loose.

2) Whether the antenna is stably connected

b) Rightly connect camera and display

1) Check whether the modulator and camera of SD3201T Transmission system are rightly connected.

2) Check whether the demodulator and display of SD3201R Receiving system are rightly connected.

c) Notes in the SD3201R/T Transceiver system transmission experiment

1) Distance between SD3201T Transmission system and SD3201R Receiving system should keep in range of 2m~5m, it is not suitable to locate them too closely or too remotely.

2) In the transmission experiment, transceiver system should work on the same channels.

3) During several sets transceiver systems experimenting simultaneously, adjacent two transceiver systems working simultaneously, channels should be selected 3-4 channels apart. Eg., a set of transceiver system works on CH1, its adjacent transceiver system should select CH4 or CH5.

d) Usage about the testing terminal

1) In SD3201R/T transceiver system's circuit modules, there are circuit outputs testing terminals, which are used to check the signal characteristics output by the circuit modules and also during the signal transmitting.

2) All the testing terminals obtain a part of the signal through a small capacitor coupling from the output terminal of the circuit, and this signal is taken as the detection signal.

e) All module experiments in the Experiments Guideline are available for independent module experiment. If it is needed, it is acceptable to customize independent modules, while not allowed to disassemble the modules in transmission or receiving system to do experiments. We will take no responsibility to the damages caused by unauthorized disassembly.

4. Service and Support

Warranty

For the technical and material's defects of the products that Suin Instruments Co., Ltd produced and sold, we promise one year warranty since the shipment day. During the warranty, as to the defective products which are proved, we will regroup or replace these defective ones based on the detailed provisions of the warranty.

Except guarantees of this outline and warranty, we factory make no any other forms of expressed or implied guarantees at all. In any case, we factory bear no responsibility with those direct, indirect or any other consequential loss.

Contact

If you have any inconvenience during the use of this product, please contact us directly.

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Website: www.suindigital.com

5. Main Specifications

5.1 Main Specifications of SD3201T Transmission System

a) Output Power: ≥8dBm

b) 1dB Compression Point Power: ≤13dBm (typ.)

c) Output Carrier Frequency: 2468MHz, 2476MHz, 2484MHz, 2492MHz, 2500MHz, 2508MHz

d) Local Oscillator Suppression: ≤-40dB (suppression to 2399MHz Local Oscillator)

e) Ground Noise: ≤ -50dBm

f) Modulation Characteristics: AM level of modulated (AM) carrier frequency>30dBm

5.2 Main Specifications of SD3201R Receiving System

a) Receiving Frequency: 2468MHz, 2476MHz, 2484MHz, 2492MHz, 2500MHz, 2508MHz

b) Receiving Sensitivity: better than -40dBm

c) Selection Characteristics: 8MHz

c) Receiving Dynamic Range ≥30dB

5.3 Transmission Characteristics of АКИП-9506 Transceiver System

a) Effectiveness

1) Basic Concept of Effectiveness

Effectiveness in the microwave communication system is amount of information communication system transmits in the specified time, which can be regarded as the representation of amount of information microwave communication system transmits. The effectiveness of information transmitting in analog communication system is always measured by system effective transmission bandwidth. The wider the system's effective transmission bandwidth is, the more the allowable channels of signals transmitting simultaneously will be, thus, the higher the system transmitting information's effectiveness will be.

2) Specification: 8MHz/channel, 6 channels in total, and transmission bandwidth is 40MHz.

b) Reliability

1) Basic Concept of Reliability: It is mainly the similarity of signal recovered by the microwave receiving terminal and the original electrical signal in the microwave transmission terminal, which can be regarded as the information's quality representation transmitted by the microwave communication system.
2) Specification: separately work on CH1/CH2/CH3/CH4/CH5/CH6 carrier frequency channels, and observe the image and audio quality on the display.
3) Transmission distance range: 2m~5m.

5.4 Environmental Conditions

Environment temperature: (20±5) ℃

Relative humidity: <80%

5.5 Power

Voltage: ~220(1±5%) V

Frequency: 50(1±5%) Hz

Total Power Consumption of transmission and reception: <60 VA

5.6 Dimensions

524mm (Length) × 431mm (Width) × 147mm (Height)

5.7 Weight

Approx. 7kg/pcs