SSA5000X

Spectrum Analyzer

Service Manual

EN_01B

SIGLENT TECHNOLOGIES CO.,LTD

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Product Certification

SIGLENT guarantees this product conforms to the national and industrial standards in China as well as the ISO9001: 2008 standard and the ISO14001:2004 standard. Other international standard conformance certification is in progress.

Important Safety Information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

General Safety Summary

Carefully read the following safety precautions to avoid personal injury and prevent damage to the instrument and any products connected to it. To avoid potential hazards, please use the instrument as specified.

To Avoid Fire or Personal Injury.

Use Proper Power Line.

Only use a local/state approved power cord for connecting the instrument to mains power sources.

Ground the Instrument.

The instrument grounds through the protective terra conductor of the power line. To avoid electric shock, the ground conductor must be connected to the earth. Make sure the instrument is grounded correctly before connect its input or output terminals.

Connect the Signal Wire Correctly.

The potential of the signal wire is equal to the earth, so do not connect the signal wire to a high voltage. Do not touch the exposed contacts or components.

Look over All Terminals' Ratings.

To avoid fire or electric shock, please look over all ratings and signed instructions of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

Equipment Maintenance and Service.

When the equipment fails, please do not dismantle the machine for maintenance. The equipment contains capacitors, power supply, transformers, and other energy storage devices, which may cause high voltage damage. The internal devices of the equipment are sensitive to static electricity, and direct contact is easy to cause irreparable damage to the equipment. It is necessary to return to the factory or the company's designated maintenance organization for maintenance.

Be sure to pull out the power supply when repairing the equipment. Live line operation is strictly prohibited. The equipment can only be powered on when the maintenance is completed and the maintenance is confirmed to be successful.

Identification of Normal State of Equipment.

After the equipment is started, there will be no alarm information and error information at the interface under normal conditions. The curve of the interface will scan from left to right freely; if there is a button in the scanning process or there is an alarm or error prompt, the device may be in an abnormal state. You need to view the specific prompt information. You can try to restart the setting. If the fault information is still in place, do not use it for testing. Contact the manufacturer or the maintenance department designated by the manufacturer to carry out maintenance to avoid the wrong test data caused by the use of the fault or endanger the personal safety.

Not Operate with Suspected Failures.

If you suspect that there is damage to the instrument, please let qualified service personnel check it.

Avoid Circuit or Wire Exposed Components Exposed.

Do not touch exposed contacts or components when the power is on.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep the surface of the instrument clean and dry.

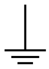
Not to use the equipment for measurements on mains circuits, not to use the equipment for measurements on voltage exceed the voltage range describe in the manual. The maximum additional transient voltage cannot exceed 1300V.

The responsible body or operator should refer to the instruction manual to preserve the protection afforded by the equipment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Any parts of the device and its accessories are not allowed to be changed or replaced, other than authorized by the manufacturer or agent.

Safety Terms and Symbols

When the following symbols or terms appear on the front or rear panel of the instrument or in this manual, they indicate special care in terms of safety.

	This symbol is used where caution is required. Refer to the accompanying information or documents to protect against personal injury or damage to the instrument.
	This symbol warns of a potential risk of shock hazard.
	This symbol is used to denote the measurement ground connection.
	This symbol is used to denote a safety ground connection.
	This symbol shows that the switch is an On/Standby switch. When it is pressed, the analyzer's state switches between Operation and Standby. This switch does not disconnect the device's power supply. To completely power off the analyzer, the power cord must be unplugged from the AC socket after the instrument is in the standby state.
	This symbol is used to represent alternating current, or "AC".
CAUTION	The "**CAUTION**" symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which may be dangerous if not followed. Do not proceed until its conditions are fully understood and met.
WARNING	The "**WARNING**" symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which, if not followed, could cause bodily injury or death. If a WARNING is indicated, do not proceed until the safety conditions are fully understood and met.

Working Environment

The design of the instrument has been verified to conform to EN 61010-1 safety standard per the following limits:

Environment

The instrument is used indoors and should be operated in a clean and dry environment with an ambient temperature range.

Note: Direct sunlight, electric heaters, and other heat sources should be considered when evaluating the ambient temperature.

⚠	**Warning:** Do not operate the instrument in explosive, dusty, or humid environments.

Ambient Temperature

Operating: 0 ℃ to +50 ℃

Non-operation: -30 ℃ to +70 ℃

Note: Direct sunlight, radiators, and other heat sources should be taken into account when assessing the ambient temperature.

Humidity

Operating: 5% ~ 90 %RH, 30 ℃, derate to 50 %RH at 40 ℃

Non-operating: 5% ~ 95% RH

Mains supply voltage fluctuations

Refer to 2.5 Power and Ground Requirements

Altitude

Operating: ≤ 3,000 m, 25 ℃

Non-operating: ≤ 12,000 m

Installation (overvoltage) Category

This product is powered by mains conforming to installation (overvoltage) Category II.

Note: Installation (overvoltage) category I refers to situations where equipment measurement terminals are connected to the source circuit. In these terminals, precautions are done to limit the transient voltage to a correspondingly low level.

Installation (overvoltage) category II refers to the local power distribution level which applies to equipment connected to the AC line (AC power).

Degree of Pollution

The analyzers may be operated in environments of Pollution Degree II.

Note: Degree of Pollution II refers to a working environment that is dry and non-conductive pollution occurs. Occasional temporary conductivity caused by condensation is expected.

IP Rating

IP20 (as defined in IEC 60529).

Cooling Requirements

This instrument relies on the forced air cooling with internal fans and ventilation openings. Care must be taken to avoid restricting the airflow around the apertures (fan holes) at each side of the analyzer. To ensure adequate ventilation it is required to leave a 15 cm (6 inch) minimum gap around the sides of the instrument.

⚠	**CAUTION:** Do not block the ventilation holes located on both sides of the analyzer.
⚠	**CAUTION:** Do not allow any foreign matter to enter the analyzer through the ventilation holes, etc.

Power and Grounding Requirements

The instrument operates with a single-phase, 100 to 240 Vrms (+/-10%) AC power at 50/60 Hz (+/-5%), or single-phase 100 to 120 Vrms (+/-10%) AC power at 400 Hz (+/-5%).

No manual voltage selection is required because the instrument automatically adapts to line voltage.

Depending on the type and number of options and accessories (probes, PC port plug-in, etc.), the instrument can consume up to 193 W of power.

Note: The instrument automatically adapts to the AC line input within the following ranges:

Voltage Range:	90 - 264 Vrms	90 - 132 Vrms
Frequency Range:	47 - 63 Hz	380 - 420 Hz

The instrument includes a grounded cord set containing a molded three-terminal polarized plug and a standard IEC320 (Type C13) connector for making line voltage and safety ground connection. The AC inlet ground terminal is connected directly to the frame of the instrument. For adequate protection against electrical shock hazards, the power cord plug must be inserted into a mating AC outlet containing a safety ground contact. Use only the power cord specified for this instrument and certified for the country of use.

Warning: Electrical Shock Hazard!

Any interruption of the protective conductor inside or outside of the analyzer, or disconnection of the safety ground terminal creates a hazardous situation. Intentional interruption is prohibited.

The position of the instrument should allow easy access to the socket. To make the instrument completely power off, unplug the instrument power cord from the AC socket.

The power cord should be unplugged from the AC outlet if the analyzer is not to be used for an extended period.

CAUTION: The outer shells of the front panel terminals are connected to the instrument's chassis and therefore to the safety ground.

Cleaning

Clean only the exterior of the instrument, using a damp, soft cloth. Do not use chemicals or abrasive elements. Under no circumstances allow moisture to penetrate the instrument. To avoid electrical shock, unplug the power cord from the AC outlet before cleaning.

⚠	**Warning:** Electrical Shock Hazard! No operator serviceable parts inside. Do not remove covers. Refer servicing to qualified personnel

Abnormal Conditions

Do not operate the analyzer if there is any visible sign of damage or has been subjected to severe transport stresses.

If you suspect the analyzer's protection has been impaired, disconnect the power cord and secure the instrument against any unintended operation.

Proper use of the instrument depends on careful reading of all instructions and labels.

⚠	**Warning:** Any use of the analyzer in a manner not specified by the manufacturer may impair the instrument's safety protection. This instrument should not be directly connected to human subjects or used for patient monitoring.

Safety Compliance

This section lists the safety standards with which the product complies.

U.S. nationally recognized testing laboratory listing

1. UL 61010-1:2012/R:2019-07. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
2. UL 61010-2-030:2018. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part2-030: Particular requirements for testing and measuring circuits.

Canadian certification

1. CAN/CSA-C22.2 No. 61010-1:2012/A1:2019-07. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
2. CAN/CSA-C22.2 No. 61010-2-030:2018. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-030: Particular requirements for testing and measuring circuits.

Contents

General Features

Siglent's SSA5000A family of spectrum analyzers offer a frequency range of 9 kHz to 26.5GHz. With their light weight, small size, and friendly user interface, the SSA5000A presents a bright easy to read display, powerful and reliable automatic measurements, and plenty of impressive features. Applications are many, but include research and development, education, production, maintenance, and many more.

Table 1 General features

Model	SPAN	Phase noise	DANL
SSA5083A	9 kHz~13.6 GHz	<-105 dBc/Hz@1 GHz, 10 kHz offset	-165 dBm/Hz
SSA5085A	9 kHz~26.5 GHz	<-105 dBc/Hz@1 GHz, 10 kHz offset	-165 dBm/Hz

- All-Digital IF Technology
- Frequency Range from 9 kHz up to 26.5 GHz
- -165 dBm/Hz Displayed Average Noise Level (Typ.)
- -105 dBc/Hz @10 kHz Offset Phase Noise (1 GHz, Typ.)
- 1 Hz Minimum Resolution Bandwidth (RBW)
- 40MHz Maximum Bandwidth
- Real-Time Spectrum Analysis
- 12.1 Inch WVGA（1280 x 800 pixels）Display

Prepare Information

Before initiating performance verification or any adjustments, it is recommended to follow these procedures. The following topics are discussed in this chapter.

- How to perform functional checks
- How to operate four standard interface tests
- How to use the self-calibration routine
- How to recall factory Default settings

For more detailed information about analyzers operation, please refer to the SSA5000A User Manual.

Functional check

Power-on Inspection

The normal operating voltage for SSA5000X series spectrum analyzers is in the range of 100-240V, 50/60Hz or 100-120V 400Hz.

Please use the power cord provided as accessories to connect the instrument to the power source as shown in the figure below.

Figure 1 Connect power cord

Note: To avoid electric shock, make sure that the instrument is correctly grounded to the earth before connecting AC power.

Press the power-on button located at the lower left corner of the front panel and some keys will illuminate for about 6 seconds. Then, the boot screen will appear on the display.

Figure 2 Front Panel

Interface Test

There are several types of interfaces: USB Host, USB Device, LAN and Earphone. Being connected to other instruments via these interfaces enables the analyzer to achieve even more enhanced capabilities. In order to ensure the analyzer is operating properly, it is recommended to first test the interfaces.

USB Host Test

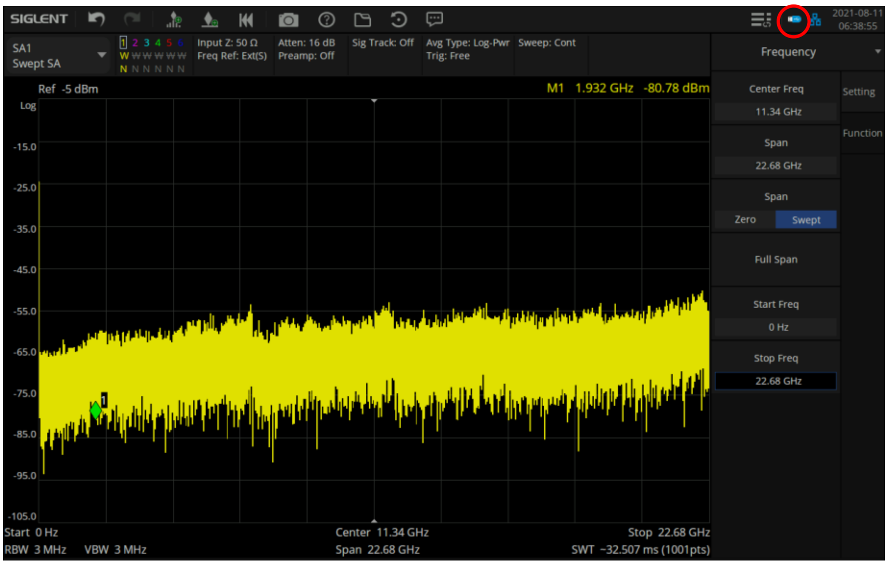
To test if the USB Host interface is working normally.

Tools:

- USB memory device (U disk)

Steps:

1. Insert a U disk into the USB Host interface on the front panel of the spectrum analyzer.
2. An icon shaped like a U disk appears on the upper right of the screen, as shown in figure below. The icon appearance indicates the U disk has been successfully recognized.



USB drive has been properly recognized

USB Device Test

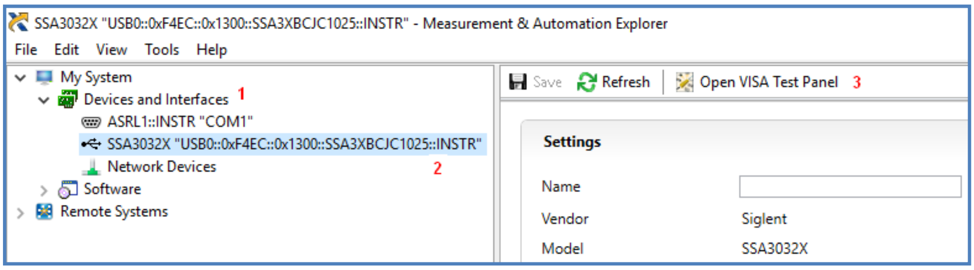
To test if the USB Device interface works normally.

Tools:

- A computer with USB interface that is compatible with running National Instruments NI-MAX software
- A standard USB cable (Type A-B)
- NI-MAX software

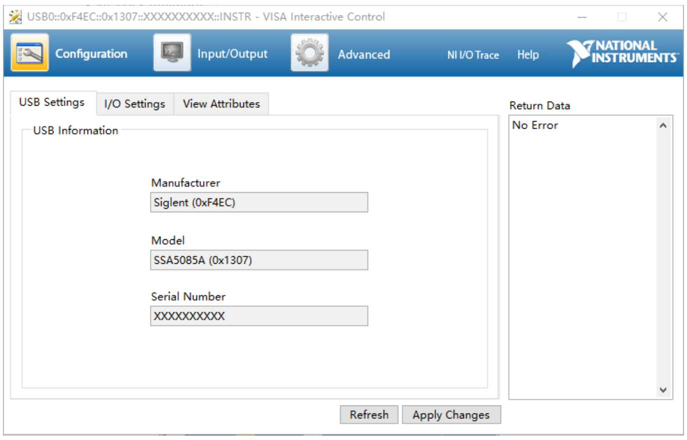
Steps:

1. Download and install National Instruments NI MAX software by following the installation instructions provided by National Instruments.
2. Connect the analyzer USB Device port and the computer using an USB cable.
3. Run NI MAX software. Click “Device and interface” at the upper left corner of the NI software interface and immediately displays the “USBTMC” device symbol.



4. Click “Open VISA Test Panel” option button, and then the following.

   Then click the “Input/Output” option button and click the “Query” option button in order to view the Read operation information.



LAN Port Test

Use to test the LAN interface functionality.

Tools:

- A computer with functional LAN interface
- A standard LAN cable

Steps:

1. Connect the spectrum analyzer and the computer using a LAN cable via LAN interface.
2. Press **System** -> **I/O Config** , Set IP Config to DHCP, as the figure below shows. The analyzer will set IP Address and Subnet Mask and Gate way automatically in this network.

   Write down the displayed IP address. It will be used in later steps.

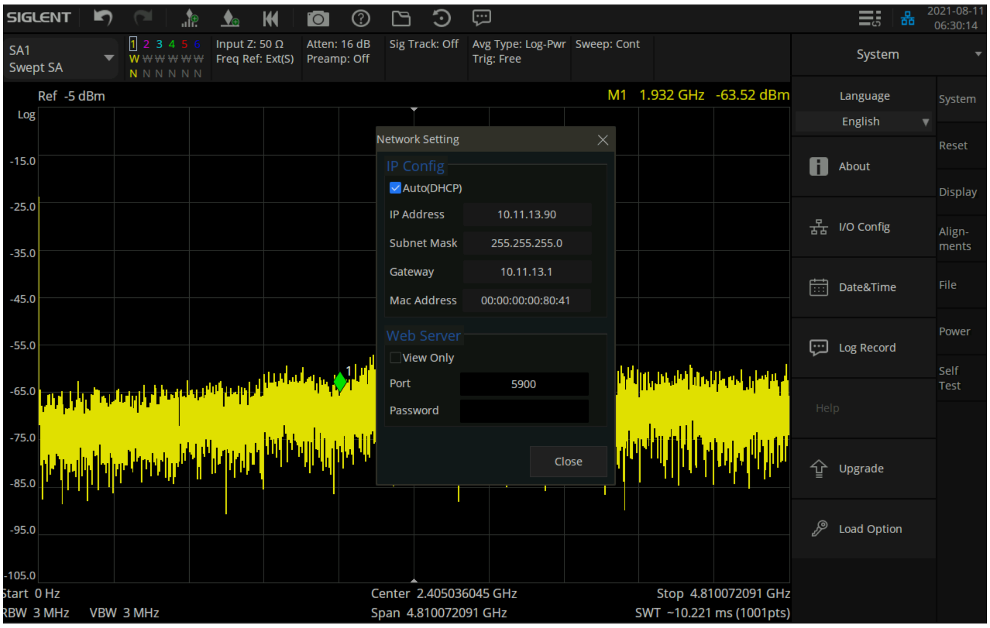


Figure 3 IP configuration interface

3. Run NI max software. Click “Device and interfaces” at the upper left corner of the NI software interface, select “Network Devices”, Add Network Device, and select VISA TCP/IP Resource as shown:

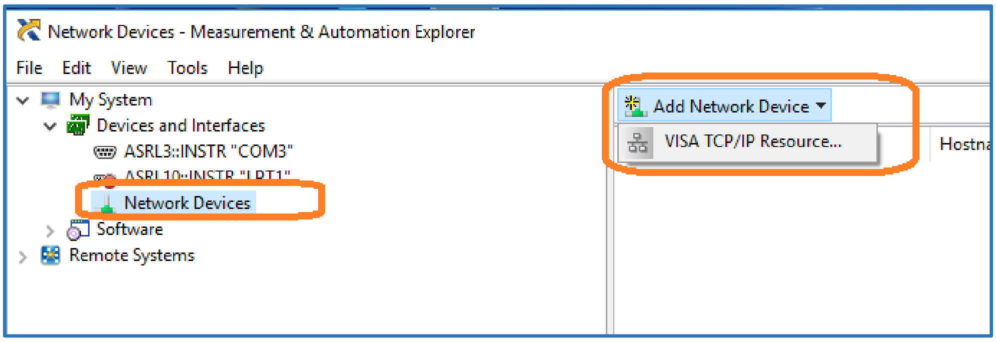


Figure 4

4. Select Manual Entry of LAN instrument, select Next , and enter the IP address as shown. Click Finish to establish the connection:

NOTE: Leave the LAN Device Name BLANK or the connection will fail.

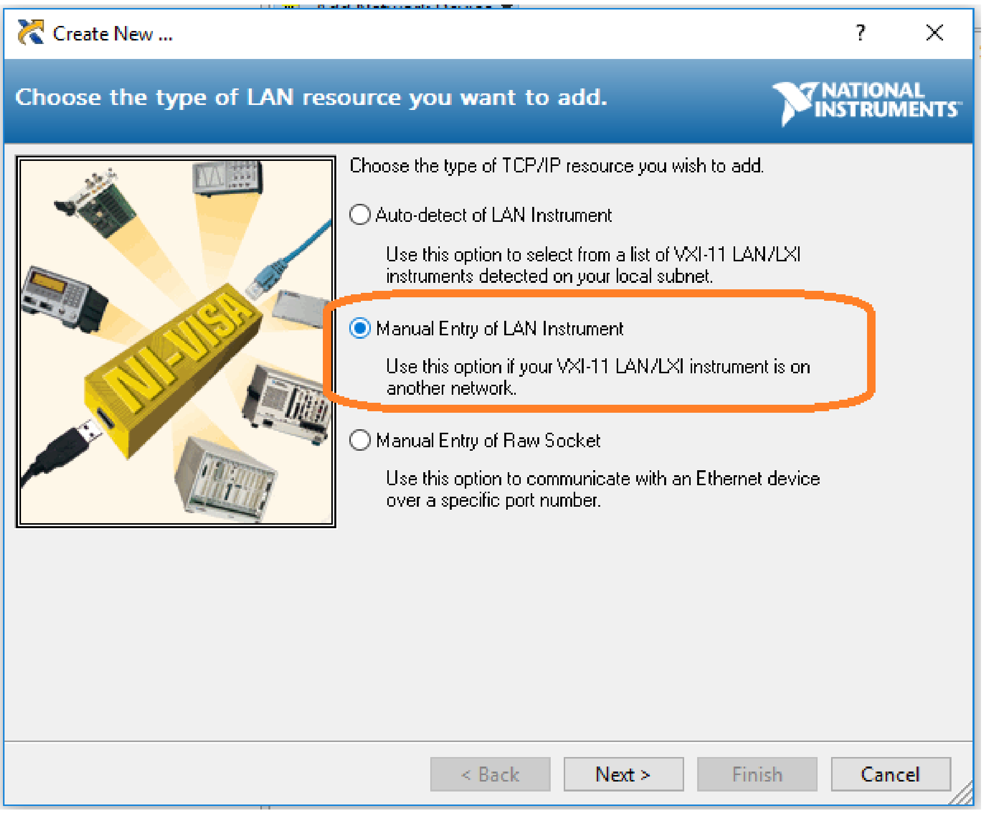


Figure 5

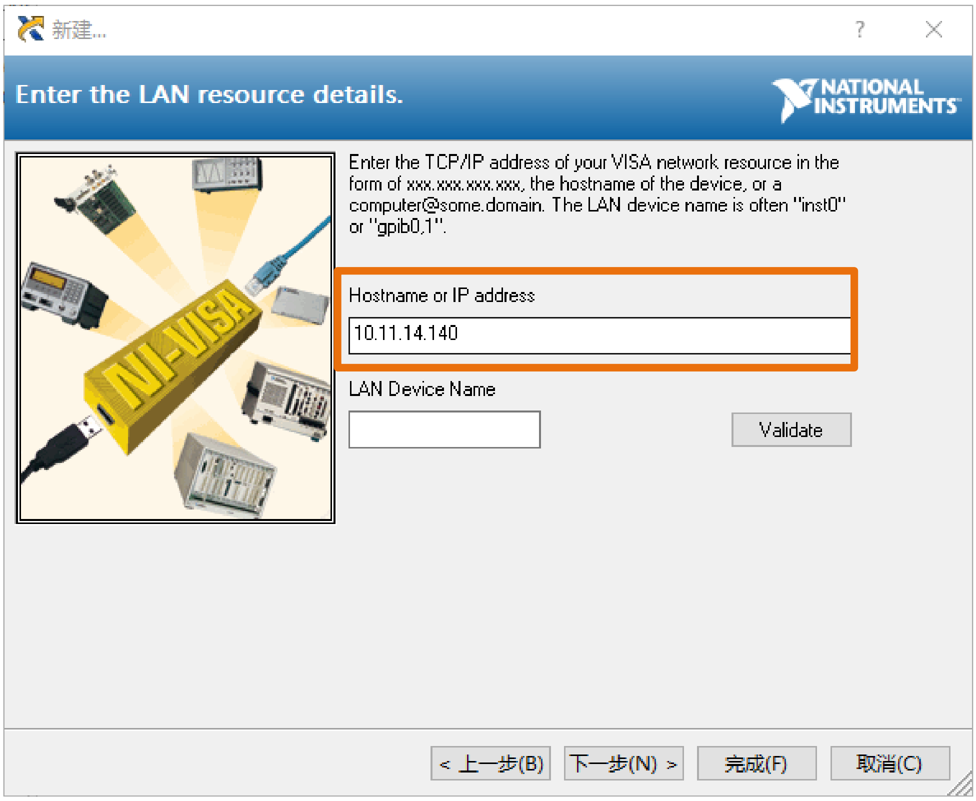


Figure 6

5. After a brief scan, the connection should be shown under Network Devices:

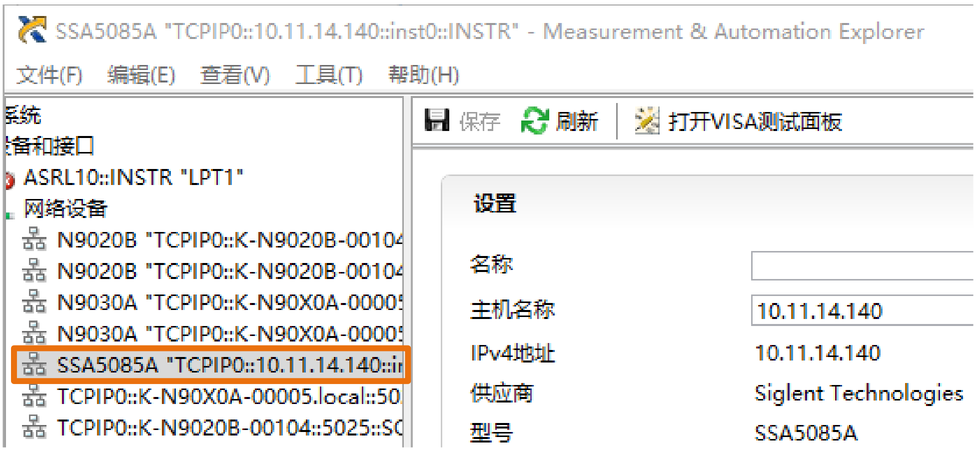


Figure 7

6. Right-click on the product and select Open NI-VISA Test Panel:

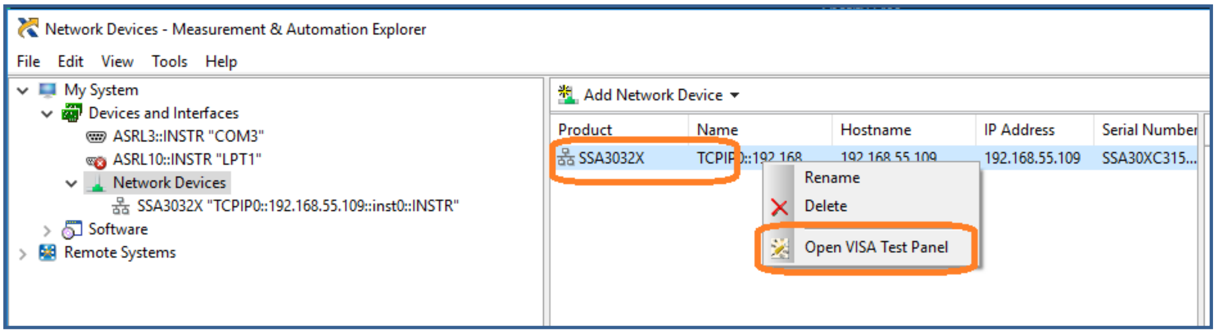


Figure 8

7. Click “Input/Output” option button and click “Query” option button. If everything is correct, you will see the Read operation information returned as shown below.

   NOTE: The *IDN? command (known as the Identification Query) should return the instrument manufacturer, instrument model, serial number, and other identification information.

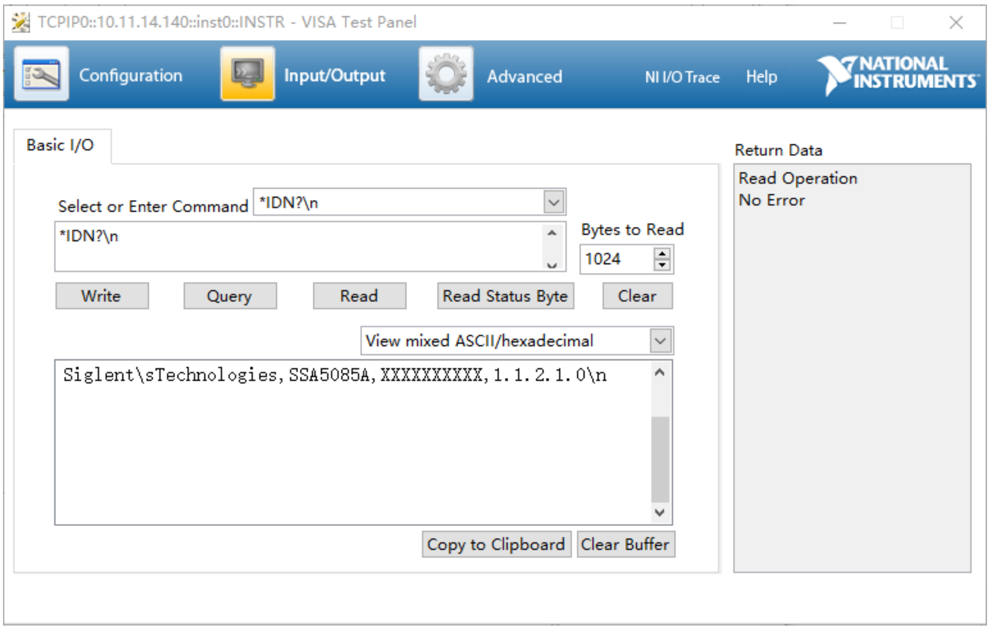


Figure 9

Performance Verification Test

This chapter explains testing the analyzer in order to verify performance specifications. For accurate test results, the test equipments and the analyzer must have been stored between 0 and 50°C for at least 2 hours prior to use, and powered on and warmed up for at least 40 minutes before testing.

Here are the required equipments:

Table 2 Test equipments

Equipment	Specification	Qty.	Recommended
Signal Generator	9 kHz~26.5GHz	1 or 2	Siglent SDG6032X(0-350MHz) and Agilent E8257D-540(250k-40GHz)
Power Meter	9 kHz~26.5 GHz	1 or 2	R&S NRP6A(9 kHz~6 GHz) and R&S NRP33S(10 MHz~33 GHz)
Frequency Counter	10 MHz	1	Agilent 53220A
Low-pass Filter	Cut-off 3200 MHz	1	
	Cut-off 7300 MHz	1	
	Cut-off 9400 MHz	1	
	Cut-off 12100 MHz	1	
Power divider	9 kHz~26.5 GHz	1	
SMA-SMA Cable	26.5 GHz	3	
N-N Cable	6 GHz	3	
BNC Cable	1 GHz	2	

Absolute Amplitude accuracy Test

Specification

20 °C to 30 °C, fc=50 MHz, RBW=VBW=1 kHz, peak detector, attenuation = 20 dB		
Absolute amplitude accuracy	Preamp off	±0.4 dB, input signal -10 dBm
	Preamp on	±0.5 dB, input signal -40 dBm

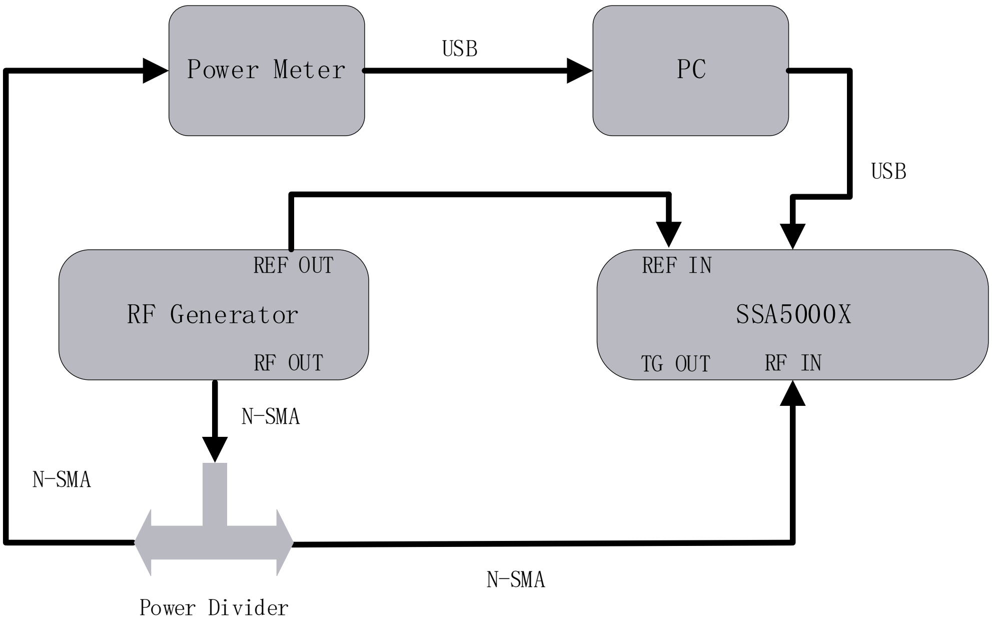


Figure 10 Diagram of Absolute Amplitude Accuracy Test System

Steps:

1. Connect the spectrum analyzer, signal generator and power meter as in Figure 10
2. Set the signal generator to output a sine waveform with 50 MHz frequency and -10 dBm amplitude and enable the output
3. Configure the spectrum analyzer:
   a) Set the center frequency to 50 MHz
   b) Set the span to 1 MHz
   c) Set the attenuation to 20 dB
   d) Set the RBW and VBW to 1 kHz
   e) Press Trace -> set Avg Times to 10, wait for trace average
4. Record measurement value P1 of the power meter

5. Press [Peak] to find the maximum value of the spectrum analyzer and record the result P2
6. Absolute amplitude accuracy = P1 – P2
7. Change the preamplifier on and set the output amplitude of the signal generator to -40dBm. Repeat steps 3 to 6 and record the results.

Record:

Preamp off			
Frequency	**P1 (Power Meter)**	**P2 (Spectrum Analyzer)**	**P1- P2**
50 MHz			
Preamp on			
Frequency	**P1 (Power Meter)**	**P2 (Spectrum Analyzer)**	**P1- P2**
50 MHz			

Frequency Response Test

Specification

20 °C to 30 °C , attenuation = 20 dB, reference frequency 50 MHz		
Preamp off	10 MHz~7.5 GHz	±1.5 dB, typ.
	7.5 GHz~13.6GHz	±2.0 dB, typ.
	13.6 GHz~26.5 GHz	±2.5 dB, typ.

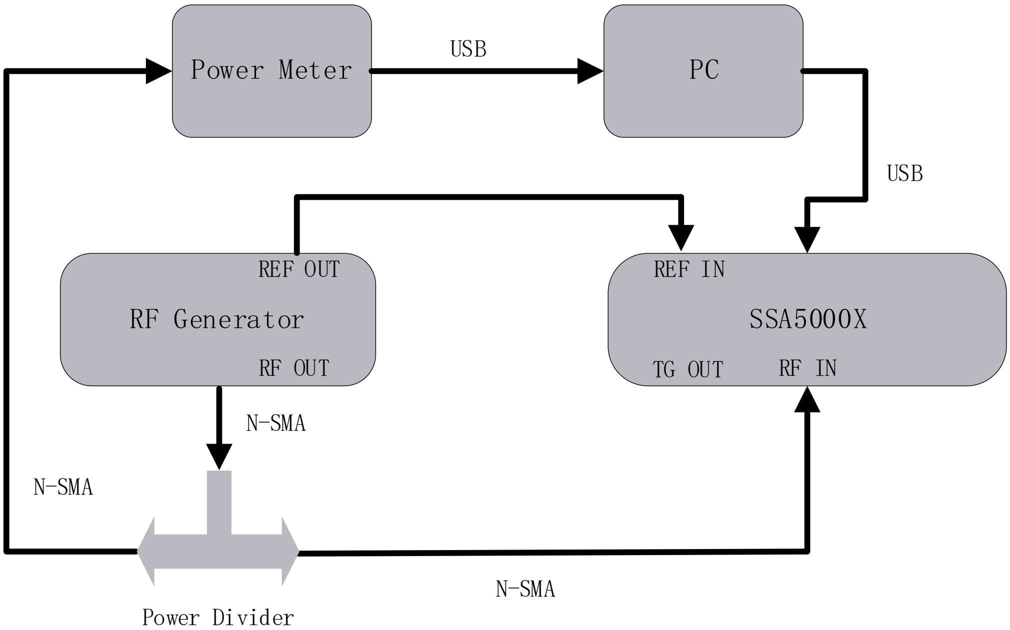


Figure 11 Diagram of Frequency Response Test System

Steps:

1. Connect the spectrum analyzer, signal generator and power meter as Figure 11 shows
2. Set the signal generator to output a sine waveform with 50 MHz frequency and -20 dBm amplitude and enable output.
3. Read the measurement of the power meter record the result as reference value P1
4. Configure the spectrum analyzer:
   a) Set the center frequency to 50 MHz
   b) Set the span to 1 MHz
   c) Set the attenuation to 20 dB
   d) Press [Peak] to find the maximum value and record as reference value P2

5. Modify the output frequency of the signal generator to 100 kHz, 1 MHz, 10 MHz, 100 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, 8 GHz, 9GHz, 10 GHz, 11 GHz, 12 GHz, 13 GHz, 14 GHz, 15 GHz, 16 GHz, 17 GHz, 19 GHz, 20 GHz, 21 GHz, 22 GHz, 23 GHz, 24 GHz, 25 GHz, 26 GHz.
6. Read the measurement of the power meter record the result as A1, SYSTEM ERROR = A1 – P1
7. Modify the center frequency of the spectrum analyzer so that it matches the signal generator and find the peak value A2, calculate the GLOBAL ERROR = A2 – P2
8. Frequency response = |GLOBAL ERROR - SYSTEM ERROR|, compare the calculated result with the specification
9. Enable the preamplifier and set the output amplitude of the signal generator to -40dBm. Repeat steps 3 to 8 and record the results.

Record:

Preamp off						
Frequency	P1 (PM)	P2 (SA)				
50 MHz						
Frequency	A1(PM)	A2(SA)	A1 – P1 (System Error)	A2 – P2 (Global Error)	Frequency Response	Pass/Fail
100 kHz						
1 MHz						
10 MHz						
100MHz						
1 GHz						
2 GHz						
3 GHz						
4 GHz						
5 GHz						
6 GHz						
7 GHz						
8 GHz						
9 GHz						

10 GHz						
11 GHz						
12 GHz						
13 GHz						
14 GHz						
15 GHz						
16 GHz						
17 GHz						
18 GHz						
19 GHz						
20 GHz						
21 GHz						
22 GHz						
23 GHz						
24 GHz						
25 GHz						
26 GHz						

Display Average Noise Level (DANL) Test

Specification

20 °C to 30 °C, attenuation = 0 dB, sample detector, trace average >50		
	Frequency	RBW=10 Hz
Preamp Off	100 kHz~1 MHz	-130 dBm,-140dBm (typ.)
	1 MHz ~10 MHz	-143dBm, -151dBm (typ.)
	10 MHz~1.22 GHz	-144dBm, -149dBm (typ.)
	1.22 GHz~3.15GHz	-143dBm, -147dBm (typ.)
	3.15 GHz~7.22GHz	-140dBm, -143dBm (typ.)
	7.22 GHz~13.6 GHz	-138dBm, -142dBm (typ.)
	13.6 GHz~18.9 GHz	-134dBm, -142dBm (typ.)
	18.9 GHz~24.2 GHz	-132dBm, -139dBm (typ.)
	24.2 GHz~26.5 GHz	-124dBm, -135dBm (typ.)
Preamp On	100 kHz~1 MHz	-135dBm, -140dBm (typ.)
	1 MHz ~10 MHz	-153dBm, -165dBm (typ.)
	10 MHz~1.22 GHz	-160dBm, -165dBm (typ.)
	1.22 GHz~3.15GHz	-158dBm, -162dBm (typ.)
	3.15 GHz~7.22GHz	-155dBm, -160dBm (typ.)
	7.22 GHz~13.6 GHz	-155dBm, -159dBm (typ.)
	13.6 GHz~18.9 GHz	-152dBm, -156dBm (typ.)
	18.9 GHz~24.2 GHz	-150dBm, -155dBm (typ.)
	24.2 GHz~26.5 GHz	-142dBm, -152dBm (typ.)

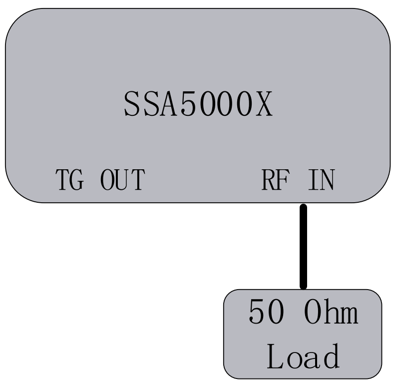


Figure 12 Diagram of DANL Test System

Step:

1. Connect a 50Ω load to the RF IN port of spectrum analyzer as the figure shows
2. Configure the spectrum analyzer:
   a) Set the start frequency to 9 kHz and the stop frequency to 100kHz
   b) Set the RBW to 10Hz and VBW to 1Hz
   c) Set the detect type to Sample
3. Press Trace -> Avg Times and wait for trace average
4. Press Peak to find the maximum noise level of this frequency range, record the marker value N
5. Change the frequency range according to the specification table and set the RBW to suitable value, repeat step 2 to 5 and test other frequency range.

Record:

	Frequency	N
Preamp Off	100 kHz~1 MHz	
	1 MHz ~10 MHz	
	10 MHz~1.22 GHz	
	1.22 GHz~3.15GHz	
	3.15 GHz~7.22GHz	
	7.22 GHz~13.6 GHz	
	13.6 GHz~18.9 GHz	
	18.9 GHz~24.2 GHz	
	24.2 GHz~26.5 GHz	
Preamp Off	100 kHz~1 MHz	
	1 MHz ~10 MHz	
	10 MHz~1.22 GHz	
	1.22 GHz~3.15GHz	
	3.15 GHz~7.22GHz	
	7.22 GHz~13.6 GHz	
	13.6 GHz~18.9 GHz	
	18.9 GHz~24.2 GHz	
	24.2 GHz~26.5 GHz	

Phase Noise Test

Specification

20 °C to 30 °C , attenuation = 0 dB, fc = 1 GHz	
Phase noise	<-103 dBc/Hz @10 kHz offset, <-106 dBc/Hz (typ.)
	<-103 dBc/Hz @100 kHz offset,<-106 dBc/Hz (typ.)
	<-116 dBc/Hz @1 MHz offset, <-119 dBc/Hz (typ.)

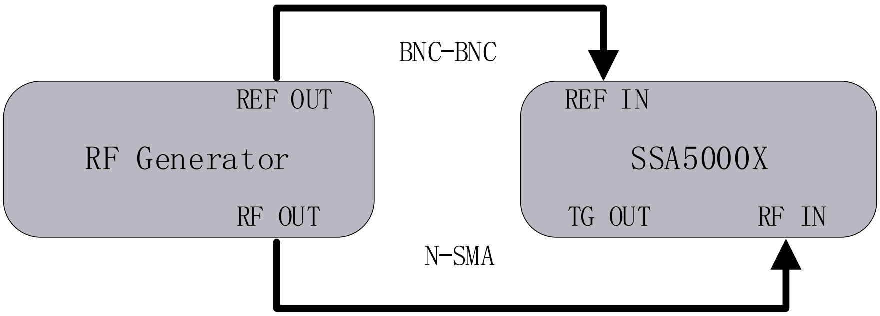


Figure 13 Diagram of Phase Noise Test System

Step:

1. Connect the signal generator and spectrum analyzer as Figure 13 shows
2. Configure the spectrum analyzer:
   a) Set the center frequency to 1 GHz
   b) Set the span to 3 MHz
   c) Set the RBW to 100 KHz
   d) Set the attenuation = 0 dB
   e) Set the detect type to Sample
3. Set the signal generator to output a sine waveform with 1000 MHz frequency and -20 dBm amplitude and enable the output
4. Press Trace -> avg Times 100 and wait for trace average.
5. Press peak to find the maximum value, record the peak value P1
6. Change marker type to delta and input 100 kHz, press Marker Fn -> Noise Marker, record the marker value P2

7. Phase noise of 1 GHz @ 1 MHz offset = P2 - P1

8. Repeat the above steps but change the span to 300, 30 KHz and the RBW to 10, 1 KHz, obtaining the phase noise about 1 GHz @ 100, 10 KHz offset

Record:

Offset @1 GHz	P1	P2	P2 - P1	Pass/Fail
10 kHz				
100 kHz				
1 MHz				

TOI Test

Specification

fc≥50 MHz, two -20 dBm tones at input mixer spaced by 100 kHz, attenuation = 0 dB, preamp off, 20 °C to 30 °C		
IIP3	50 MHz~7.22 GHz	11 dBm, 15 dBm (typ.)
	7.22 GHz~26.5 GHz	10 dBm, 14 dBm (typ.)

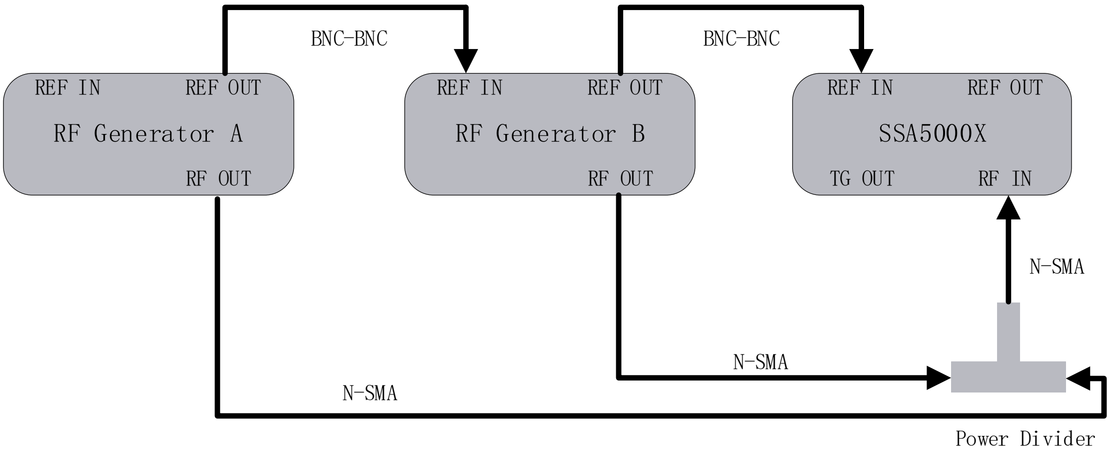


Figure 14 Diagram of TOI Test System

Step:

1. Connect double signal generators to a power divider. The output of the divider connect RF IN port of spectrum analyzer.
2. Configure the spectrum analyzer:
   a) Set the center frequency to 50 MHz
   b) Set the span to 1 MHz
   c) Set the RBW to 10 kHz
   d) Set the attenuation = 0 dB
3. Set the signal generator A to output a sine waveform with 50 MHz frequency and -20 dBm amplitude and enable output
4. Set the signal generator B to output a sine waveform with 50.1 MHz frequency and -20 dBm amplitude and enable output
5. Press Trace -> avg Times 100, and wait for trace average

6. Press Peak to find the maximum value, then change the marker type to delta and press Next Peak twice, record delta amplitude value DELTA.
7. IIP3 = -20dBm – DELTA/2, check if the calculate result ≥ +11 dBm.
8. Change the center frequency to 8 GHz and the frequency of sine waveform A and B to 50 MHz and 50.1 MHz, then repeat step 5 to step 7 but check if the calculate result ≥ +10 dBm.

Record:

Offset	DELTA	IIP3	Pass/Fail
50 MHz			
50.1 MHz			
8000 MHz			
8000.1 MHz			

Frequency Accuracy Test

Specification

20 °C to 30 °C, fc=10MHz	
Reference frequency	10.000000 MHz
Initial calibration accuracy	<1 ppm

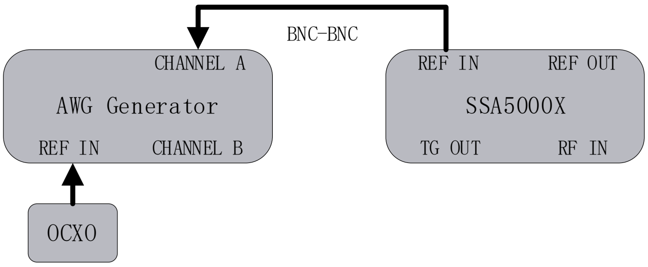


Figure 15 Diagram of Frequency Accuracy Test System

Steps:

1. Connect ref out port of the spectrum analyzer to the channel A of the SDG2042X, which referenced by an OCXO
2. Set the SDG2042X to frequency counter mode, and set frequency ref to 10.000000 MHz
3. Check if the frequency deviation ≤ 1 ppm

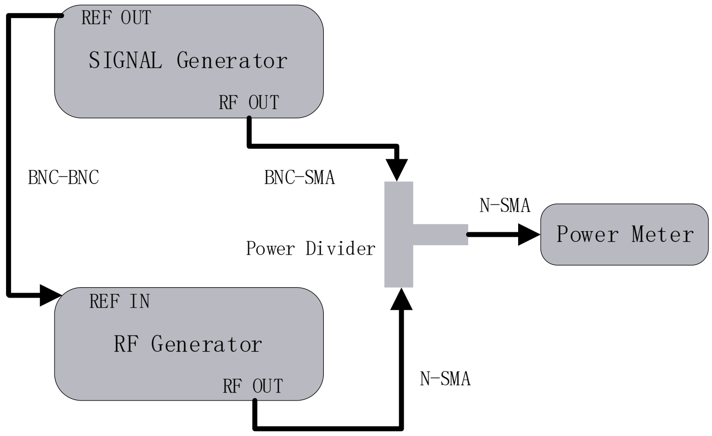
Record:

Frequency	Frequency Deviation	Pass/Fail
10.000000 MHz		

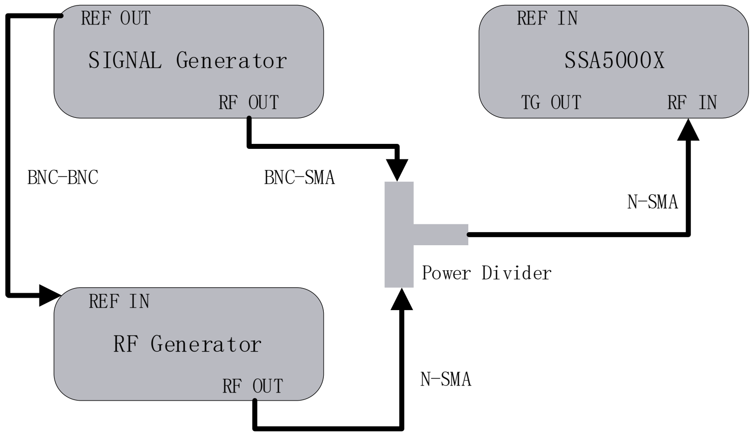
1dB Gain Compression Test

Specification

20 °C to 30 °C, fc=50MHz, attenuation = 0 dB, preamp off	
1dB Gain Compression	>-5dBm



(a)



(b)

Figure 16 Diagram of 1dB Gain Compression Test System

Steps:

1. Connect the signal generator, RF generator and power meter as Figure 16(a) shows
2. Set the output frequency of signal generator 50 MHz and the amplitude to -25 dBm. Set the output frequency of RF generator to 53 MHz and the amplitude to -5 dBm.

3. Enable the output of signal generator and disable the output of RF generator. Observe the measurement value of the power meter. Adjust the output amplitude of signal generator until the reading of the power meter becomes -25 dBm.
4. Enable the output of RF generator and disable the output of signal generator. Observe the measurement value of the power meter. Adjust the output amplitude of RF generator until the reading of the power meter becomes -5 dBm.
5. Disconnect the power divider and power meter and connect the power divider with spectrum analyzer, as shown in Figure 16(b).
6. Enable the output of signal generator and disable the output of RF generator.
7. Configure the spectrum analyzer:
   a) Set the center frequency to 50 MHz.
   b) Set the span to 100 kHz.
   c) Set the reference level to -25 dBm.
   d) Set the input attenuation to 0 dB.
   e) Set the resolution bandwidth to 1 kHz.
   f) Set the sweep time to auto and the auto sweep time to accuracy.
8. Press Peak to find the maximum value and record as reference value P1.
9. Enable the output of signal generator and the output of RF generator, find the peak value P2.

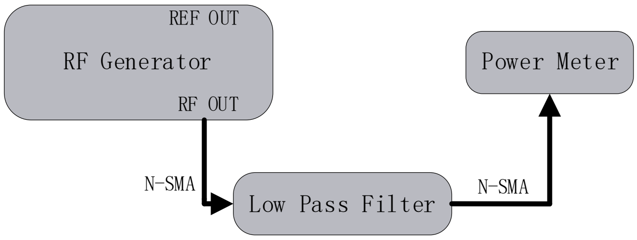
Record:

P1	P2	P1 – P2

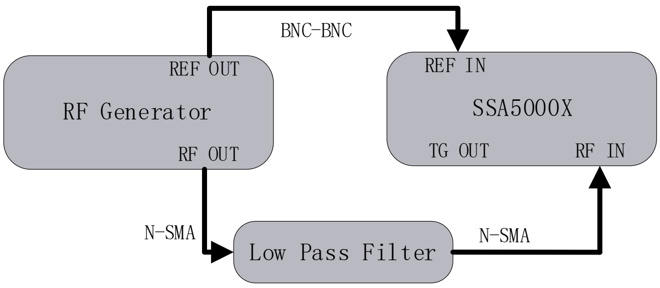
Second Harmonic Distortion Test

Specification

20 °C to 30 °C, fc=50MHz, attenuation = 0 dB, preamp off, mixer level=-30dBm	
10 MHz~7.22 GHz	<-62dBc
7.22 GHz~26.5 GHz	<-74dBc



(a)



(b)

Figure 17 Diagram of Second Harmonic Distortion Test System

Steps:

1. Connect the RF generator, 3200 MHz low pass filter and power meter as figure 3-8(a) shows
2. Set the output frequency of the RF generator to 3200 MHz and the amplitude to -20 dBm. Observe the measurement value of the power meter. Adjust the output amplitude of RF generator until the reading of the power meter becomes -20 dBm.
3. Connect the RF generator, 32000MHz low pass filter and spectrum analyzer as figure 3-8(b) shows. Enable the output of RF generator.
4. Configure the spectrum analyzer:
   a) Set the center frequency to 3200 MHz.

b) Set the span to 10 kHz.

c) Set the reference level to -20 dBm.

d) Set the input attenuation to 0 dB.

e) Set the resolution bandwidth to 300 Hz.

f) Set the video bandwidth to 10 Hz.

g) Set the sweep time to auto and the auto sweep time to accuracy.

h) Press Trace -> avg Times 100 and wait for trace average.

5. Press Peak to find the maximum value P1. Then, double the center frequency of spectrum analyzer to 100 MHz, Press Peak to find the maximum value P2.

6. According to the table change the output frequency of RF generator and center frequency of spectrum analyzer and the low pass filter, then repeat the step 4 to step 5.

Record:

Frequency	P1	P2	P1 – P2
3200 MHz			
7300 MHz			
9400 MHz			
12100 MHz			

Input Attenuation Error Test

Specification

20 °C to 30 °C, fc=50 MHz, preamp off, mixer level=-30dBm	
1 MHz~ 7.22 GHz	<±0.5dB
7.22 GHz~26.5 GHz	<±0.7dB

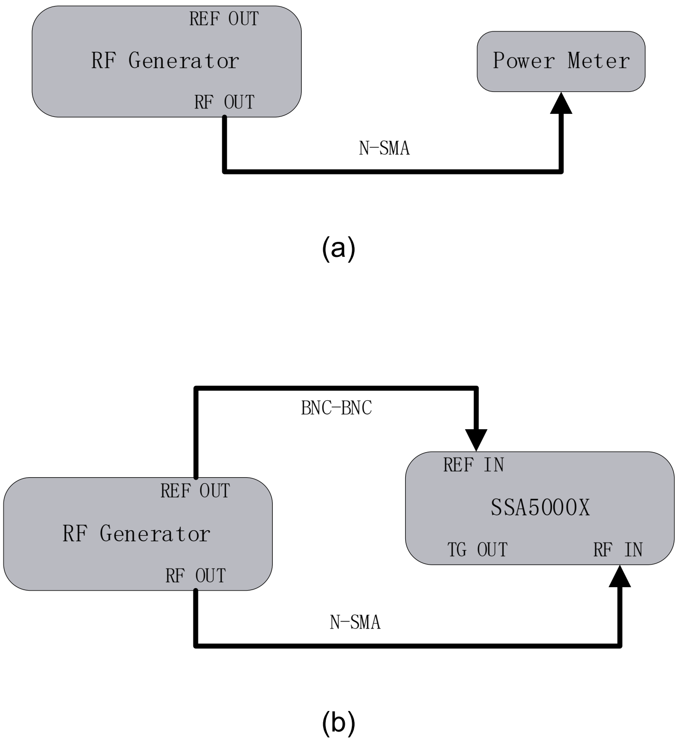


Figure 18 Diagram of the Input Attenuation Error Test System

Steps:

1. Connect the RF generator and power meter as shown in figure 3-9(a).
2. Set the output frequency of the RF generator to 50 MHz and the amplitude to -30 dBm. Observe the measurement value of the power meter. Adjust the output amplitude of RF generator until the reading of the power meter becomes -30 dBm. Read the output amplitude from RF generator, record it as P_{-30}.
3. Adjust the output amplitude of RF generator until the reading of the power meter becomes -25, -20, -15, -10, -5, 0, 5, 10, 15, 20 dBm respectively. Record these values as P_{-25}, P_{-20}, P_{-15}, P_{-10}, P_{-5}, P_0, P_5, P_{10}, P_{15}, P_{20}.
4. Connect the RF generator and spectrum analyzer as figure 3-2(b) shows.

5. Set the output frequency of the RF generator to 50 MHz and the amplitude to P_{-10}.
6. Configure the spectrum analyzer:
   a) Set the center frequency to 50 MHz.
   b) Set the span to 10 kHz.
   c) Set the reference level to 0 dBm.
   d) Set the input attenuation to 20 dB.
   e) Set the resolution bandwidth to 1 kHz and the video bandwidth to 10 Hz.
   f) Set the sweep time to auto and the auto sweep time to accuracy.
7. Press [Peak] to find the maximum value. Record it as reference value P (ATT=20dB).
8. Change the output amplitude of the RF generator to P_{-30}。Set the input attenuation of the spectrum analyzer to 0dB. Press [Peak] to find the maximum value. Record it as reference value P (ATT=0dB).
9. Repeat the step 8, record the value

   P (ATT=5 dB),

   P (ATT=10 dB),

   P (ATT=15 dB),

   P (ATT=25 dB),

   P (ATT=30 dB),

   P (ATT=35 dB),

   P (ATT=40 dB),

   P (ATT=45 dB),

   P (ATT=50 dB).

   Error (ATT=0dB) = P(ATT=0dB) - (-30) - P(ATT=20dB) - (-10),

   Error (ATT=5dB) = P(ATT=5dB) - (-25) - P(ATT=20dB) - (-10),

   Error (ATT=10dB) = P(ATT=10dB) - (-20) - P(ATT=20dB) - (-10),

   Error (ATT=15dB) = P(ATT=15dB) - (-15) - P(ATT=20dB) - (-10),

   Error (ATT=25dB) = P(ATT=25dB) - (-5) - P(ATT=20dB) - (-10),

   Error (ATT=30dB) = P(ATT=30dB) - (0) - P(ATT=20dB) - (-10), Error (ATT=35dB) = P(ATT=35dB) - (5) - P(ATT=20dB) - (-10),

Error (ATT=40dB) = P(ATT=40dB) - (10) - P(ATT=20dB) - (-10),

Error (ATT=45dB) = P(ATT=45dB) - (15) - P(ATT=20dB) - (-10).

Error (ATT=50dB) = P(ATT=50dB) - (20) - P(ATT=20dB) - (-10).

Record:

50MHz	$P_{0\sim-30}$	ATT	P(ATT=0~30dB)	Error
P_0		0		
P_{-5}		5		
P_{-10}		10		
P_{-15}		15		
P_{-20}		20		——
P_{-25}		25		
P_{-30}		30		
P_{-35}		35		
P_{-40}		40		
P_{-45}		45		
P_{-50}		50		

8000MHz	$P_{0\sim-30}$	ATT	P(ATT=0~30dB)	Error
P_0		0		
P_{-5}		5		
P_{-10}		10		
P_{-15}		15		
P_{-20}		20		——
P_{-25}		25		
P_{-30}		30		
P_{-35}		35		
P_{-40}		40		
P_{-45}		45		
P_{-50}		50		

Assembly Procedures

This chapter describes how to remove the major modules from the SSA5000X spectrum analyzer. To install the removed modules or replace new modules, please follow the corresponding operating steps in reverse order.

This chapter includes the following topics:

- **Security Consideration** which describes security information needed to consider while operating.
- **List of Modules** in which the modules to remove are listed.
- **Required Tools** which describes the tools needed to perform the procedures.
- **Disassembly Procedures** which describes in detail how to remove and install the modules.

Security Consideration

Only qualified personnel should perform the disassembly procedures. Whenever possible, disconnect the power before you begin to remove or replace the modules. Otherwise, possible personal injuries or damages to the components may occur.

Avoid Electrical Shock Hazardous voltages exist on the LCD module and power supply module. To avoid electrical shock, first disconnect the power cord from the analyzers and then wait at least three minutes for the capacitors in the analyzers to discharge before you begin disassembly.

Preventing ESD Electrostatic discharge (ESD) can damage electronic components. When doing any of the procedures in this chapter, use proper ESD precautions. As a minimum, place the analyzers on a properly grounded ESD mat and wear a properly grounded ESD strap.

List of Modules

The following removable modules are listed in the order of performing disassembly procedures.

Table 3 List of modules

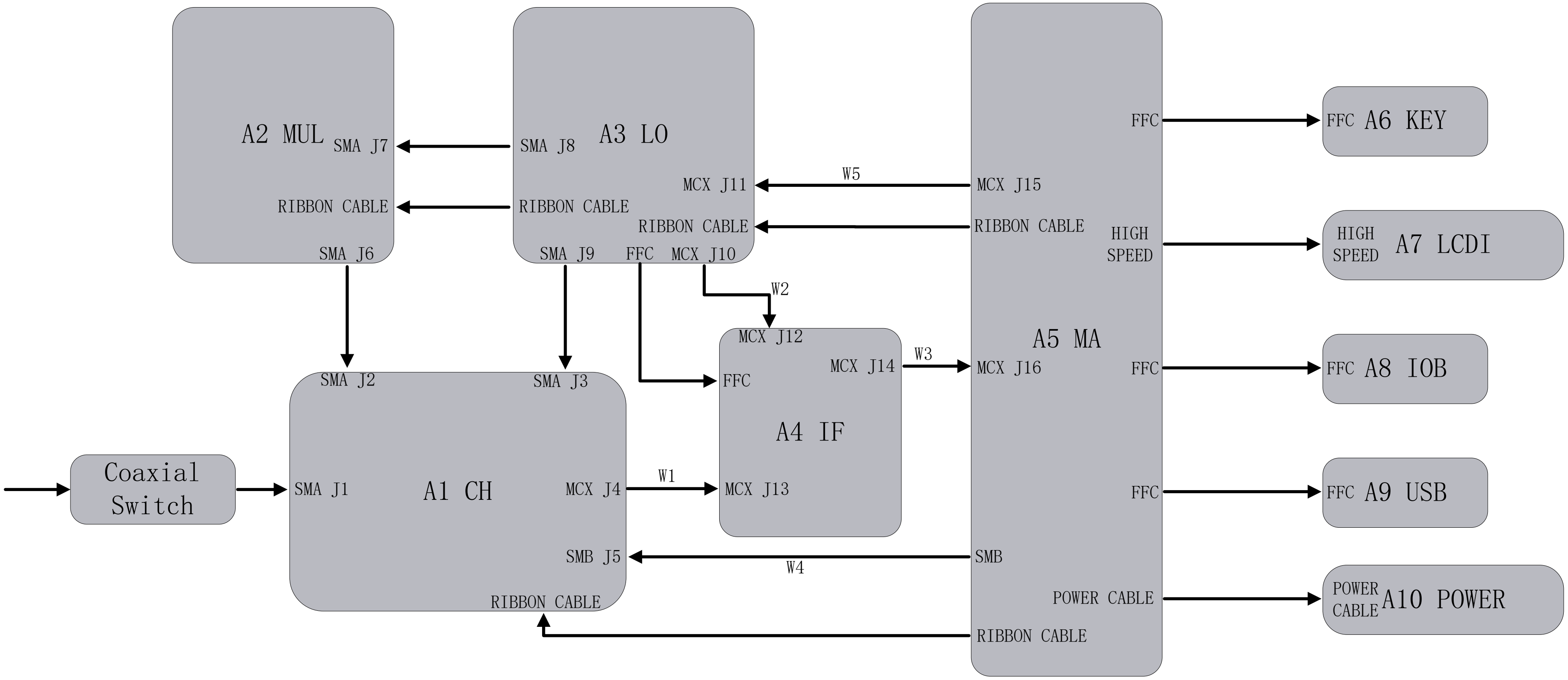
Number of Module	Module
1	Back-Shell
2	Rear Metal Cover
3	Local Oscillator board
4	Frequency Multiplier Board
5	Channel Board
6	Intermediate Board
8	Main Board
9	Front Metal Cover
10	Key Board
11	LCDI Board
12	IOB Board
13	USB Board
14	Power Board

Required Tools

Use these tools to remove or replace the modules in the analyzers:

- Multifunctional screwdriver
- Antistatic gloves
- Custom screw hexagonal nut tool or long nose pliers

Diagram of Spectrum Analyzer



Introduction of RF Cable and Interface

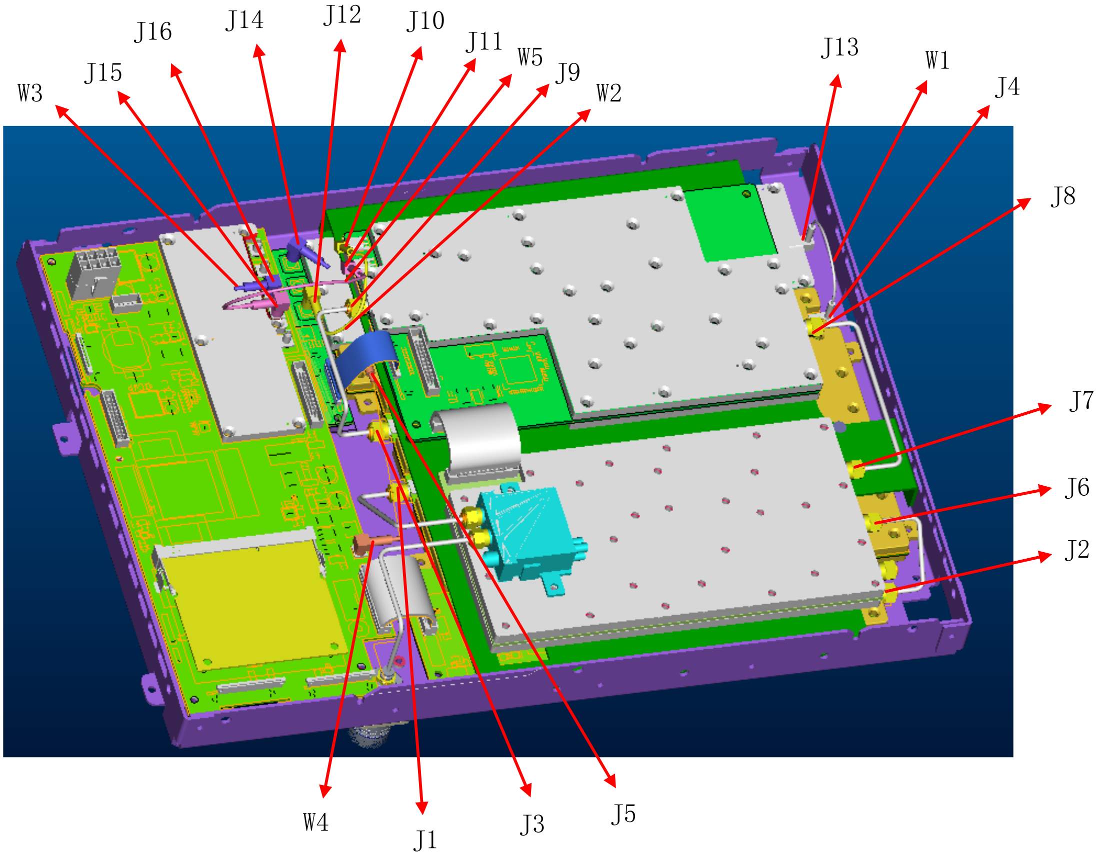


Figure 19 Code of the RF Cable and Interface.

The connection relationship shown in the following table:

W1	J4 to J13	MCX to MCX
W2	J10 to J12	MCX to MCX
W3	J14 to J16	MCX to MCX
W4	J17 to J15	SMB to SMB
W5	J15 to J11	MCX to MCX

Disassembly Procedures

This section describes how to remove and install the modules listed above in the spectrum analyzer in detail. Complete disassembly will be best achieved through the following operating steps.

Removing the Back-Shell

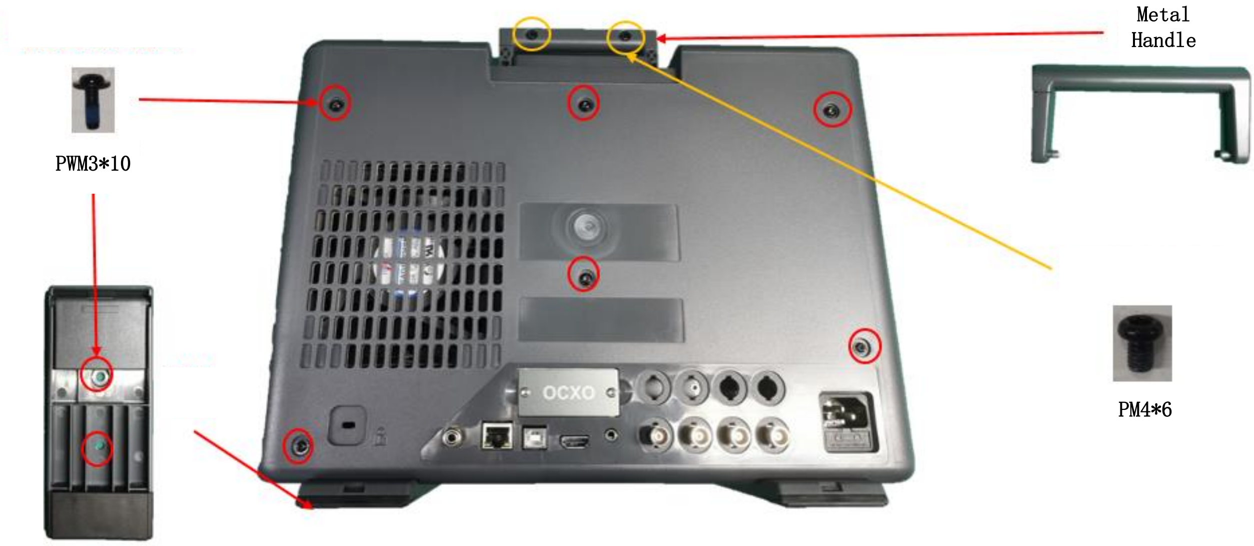


Figure 20 Picture of the Back-Shell.

Removal steps:

1. Remove each screws of Back-Shell as shown in figures above.
2. Remove the Metal Handle.
3. Remove the Back-Shell slowly.

To install the rear metal cover, please perform these steps in reverse order.

Removing the Rear Metal Cover

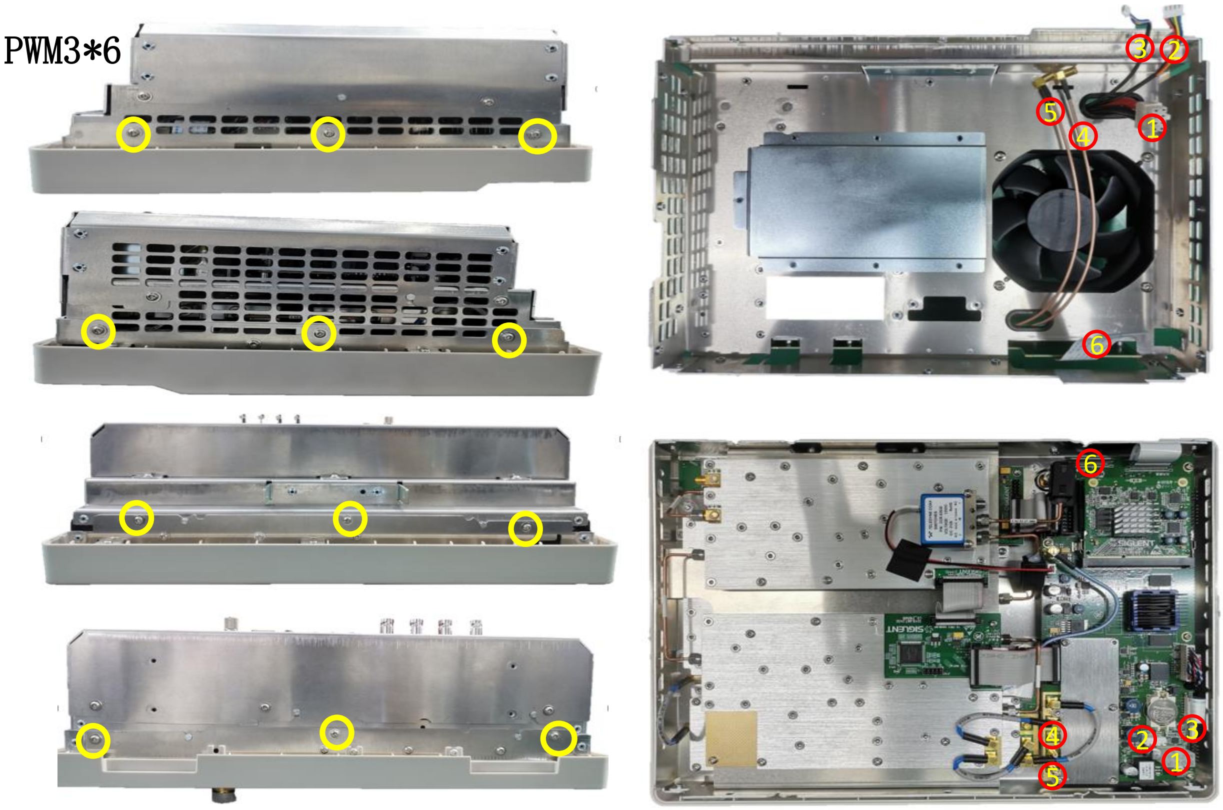


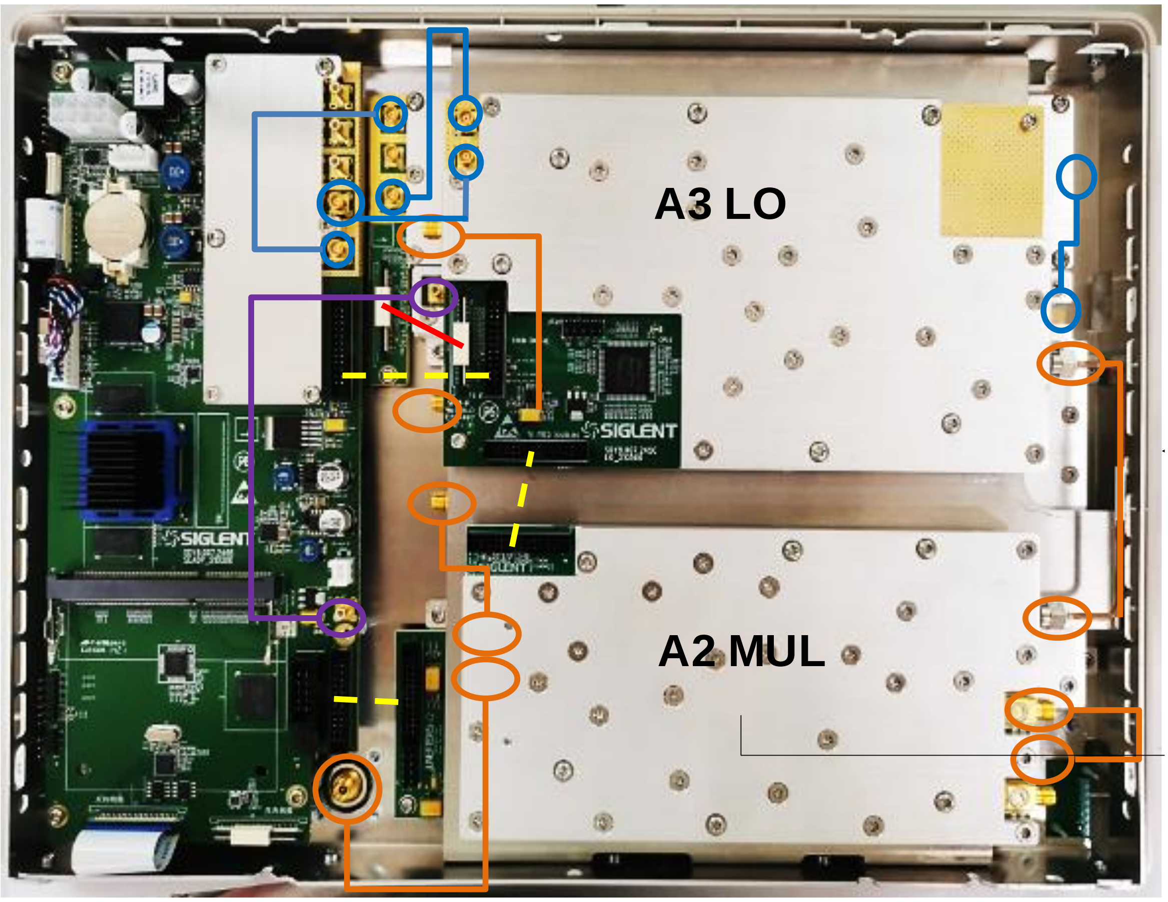
Figure 21 Diagram for removing rear metal cover.

Removal steps:

1. Place the analyzer down on a soft surface such as an anti-static mat.
2. Remove the twelve screws located on the rear metal cover.
3. Lift the rear metal cover up carefully.
4. Disconnecting the cable marked number one to number six.
5. The edge of the rear metal cover is sharp, please lift the rear metal cover up and off carefully to avoid personal injury.

To install the rear metal cover, please perform these steps in reverse order.

Removing the Local Oscillator Board, Frequency Multiplier Board, Channel Board, Intermediate Frequency Board



Removal steps:

1. Disconnecting all the connection of the cables is suggested, before you start remove the local oscillator board and frequency multiplier board.
2. Remove the coaxial switch on channel board.
3. Remove the screws on local oscillator board and frequency multiplier board marked red and yellow circle.
4. Remove the screws located on the side of front metal cover.
5. Remove the supporting cover.

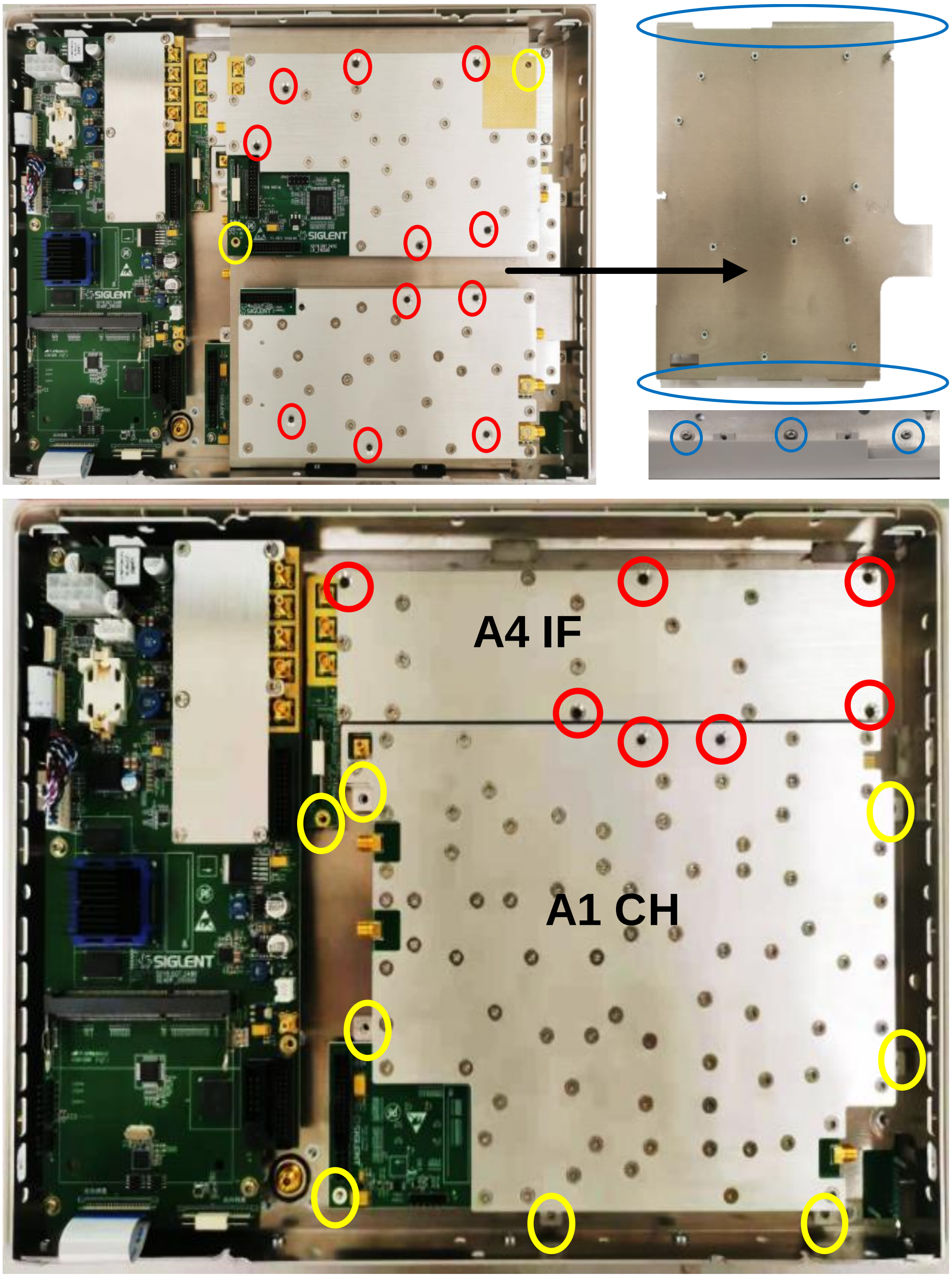


Figure 22 Diagram for removing A1, A2, A3, A4.

6. Remove all the screws on channel board and intermediate frequency board marked red and yellow circle.
7. Remove the channel board and intermediate frequency board.

   To install the channel board and intermediate frequency board, please perform these steps in reverse order.

Removing the Main Board

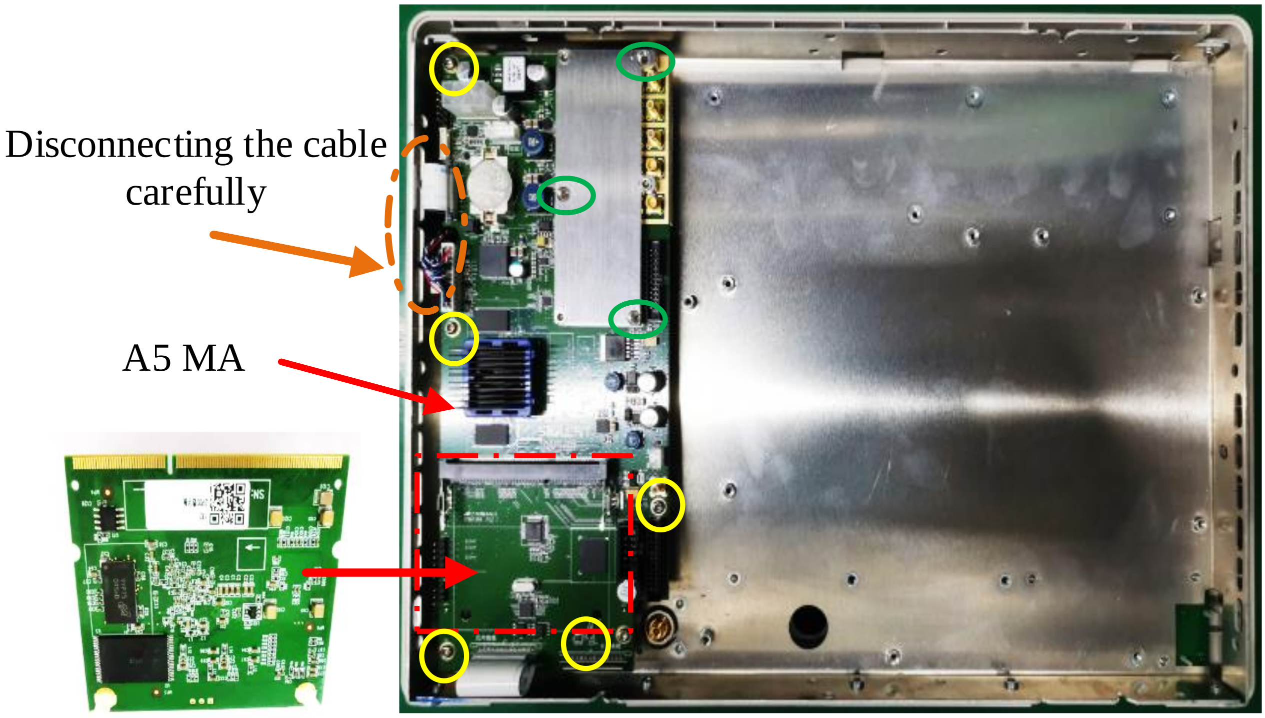


Figure 23 Diagram for removing A5

Removal steps:

1. Remove the screws on main board marked yellow and green circle.
2. Disconnecting the connection of key board and touch panel to main board marked brown circle.
3. Remove sub board from the main board.
4. Remove the main board.

   To install the main board, please perform these steps in reverse order.

5. Remove the seven screws located on the keyboard.
6. Disconnect the cable that connected the keyboard and the channel board.
7. Separate the modules carefully.

To install the main board, please perform the above steps in converse order.

Removing the Front Metal Cover

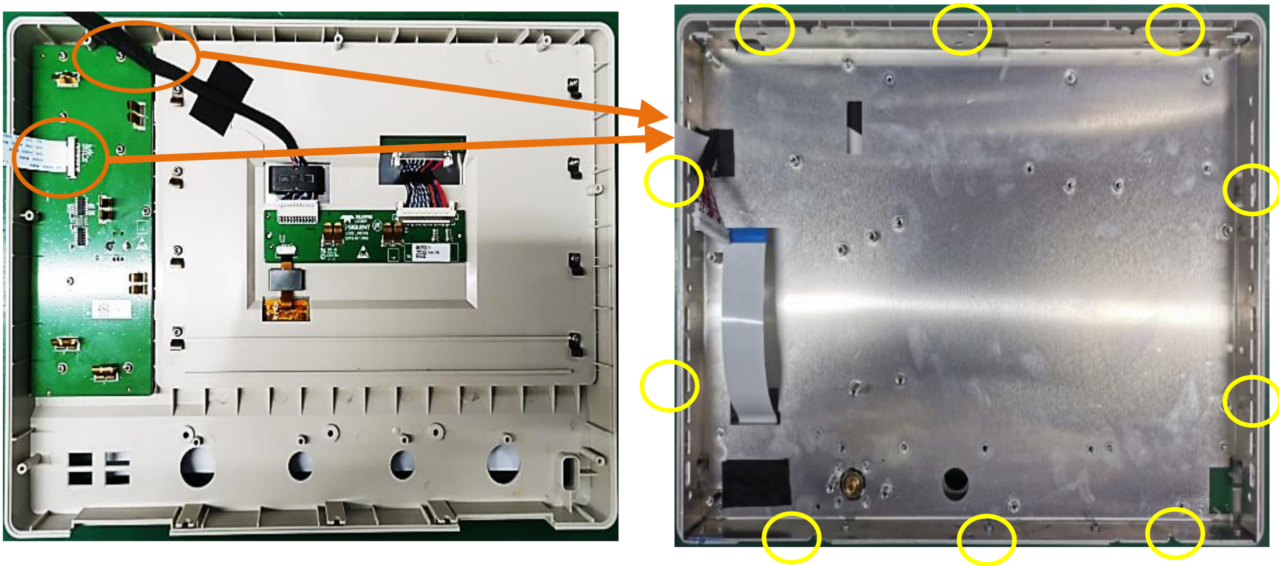


Figure 24 Diagram for removing front metal cover.

1. Remove the screws marked yellow circle.
2. Remove the front metal cover carefully.

To install the front metal cover, please perform these steps in reverse order.

Removing the Key Board and LCDI Board

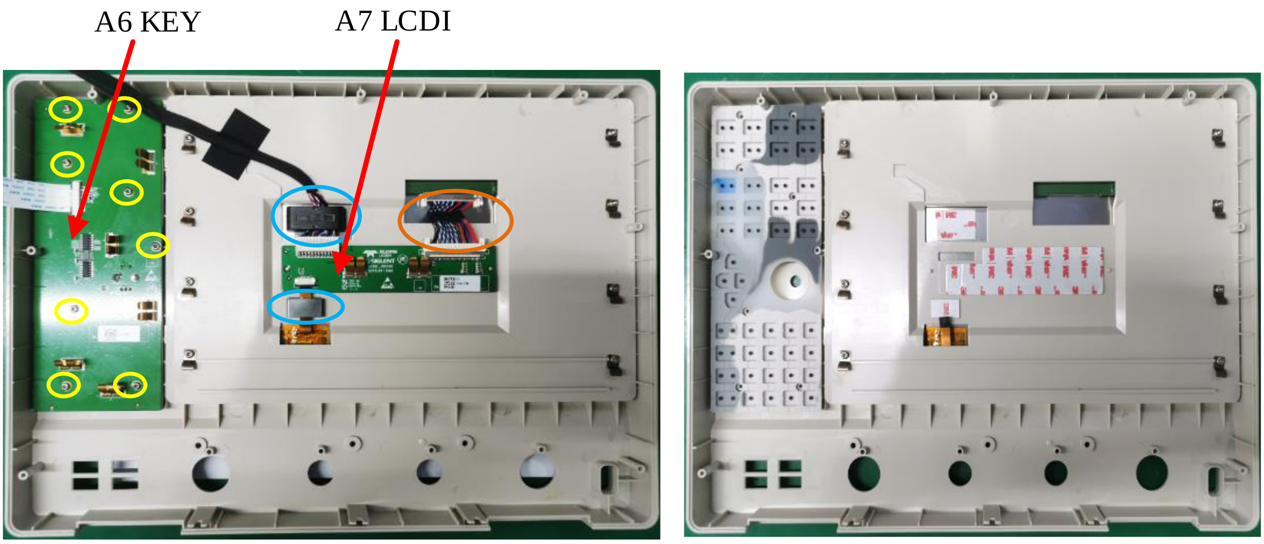


Figure 25 Diagram for removing A6, A7.

1. Remove the screws marked yellow circle.
2. Disconnecting the connection marked blue circle (magnetic ring) and brown circle (screen line group).
3. Remove the key board and LCDI board.

To install the key board and LCDI board, please perform the above steps in converse order.

Removing the USB Board

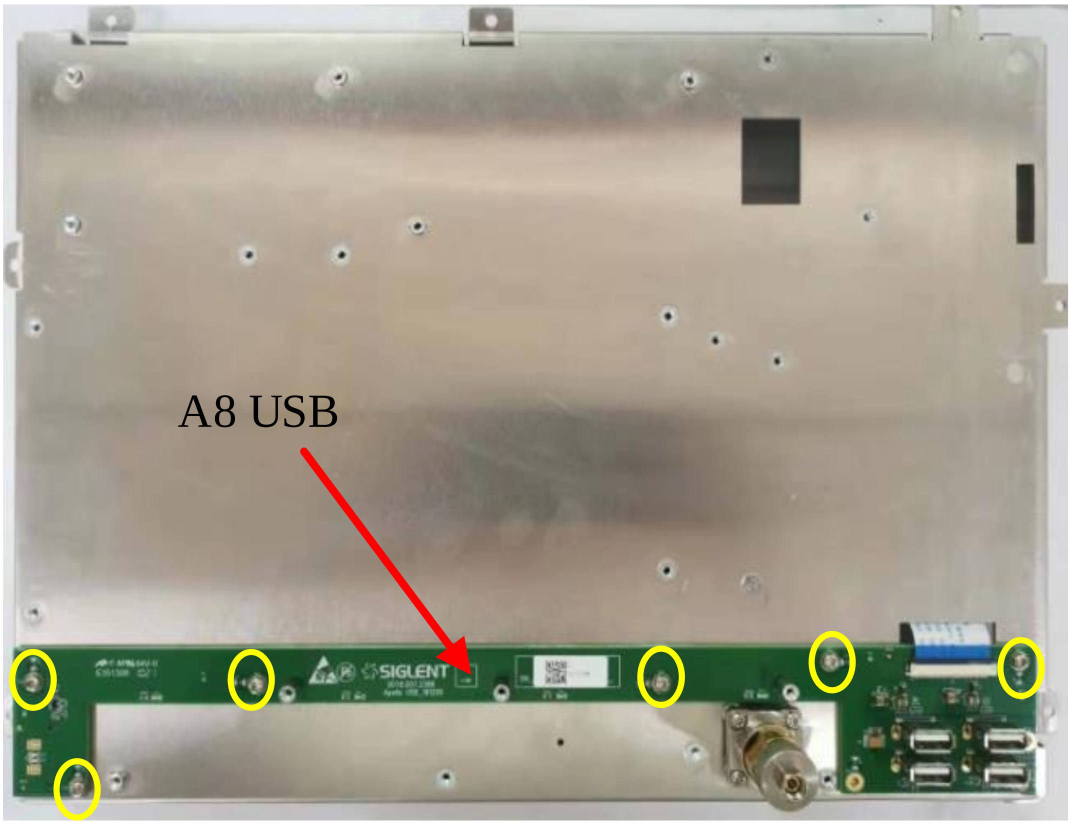
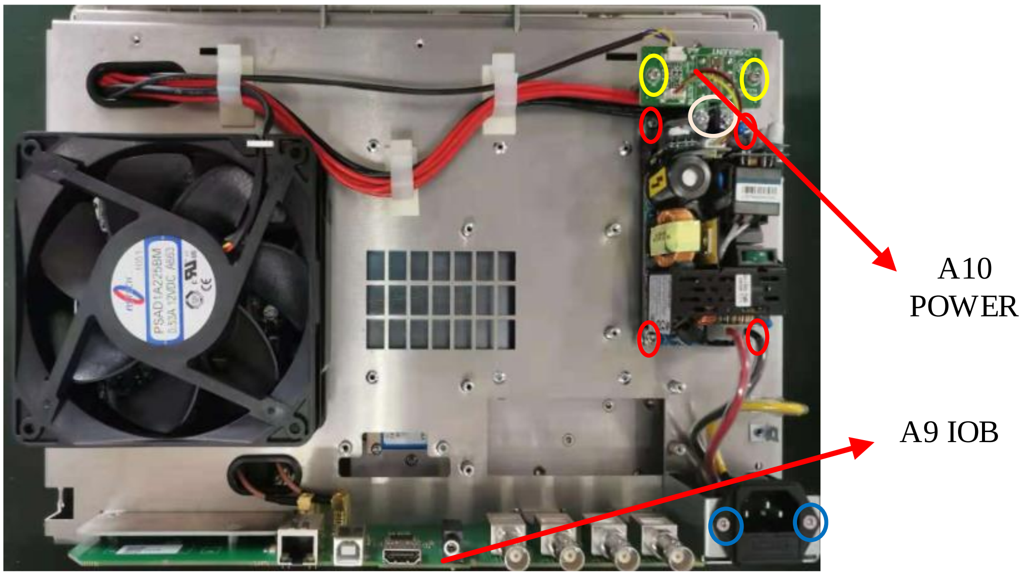


Figure 26 Diagram for removing A8.

1. Remove the screws marked yellow circle.
2. Remove the USB Board from the front metal cover (Pull out FFC line carefully).

To install the USB board, please perform the above steps in converse order.

Removing the Power Supply Board and IOB Board



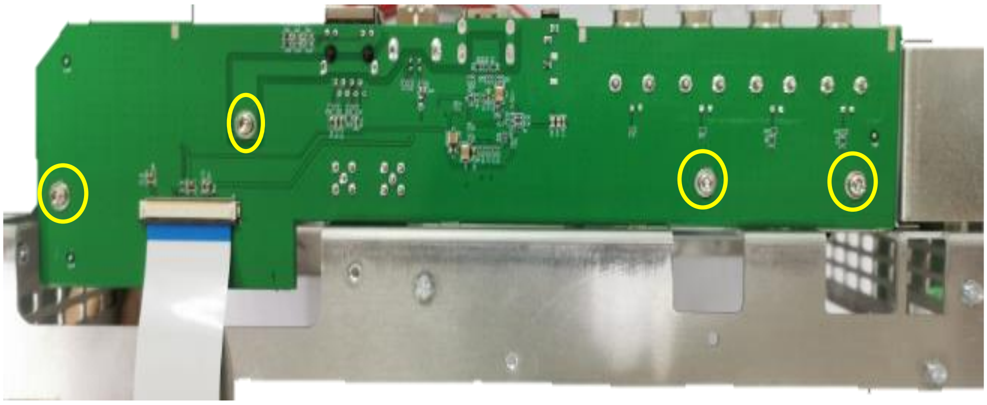


Figure 27 Diagram for removing A9, A10.

1. Remove the screws in Power Supply Board marked yellow red circle.
2. Disconnecting all the cable of the Power Supply Board.
3. Remove the Power Supply Board.
4. Remove the screws in IOB Board marked yellow circle.
5. Remover the IOB Board.

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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.

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