USER'S MANUAL

Handheld Spectrum Analyzer

DSA2016TG/DSA2016
V1.0.0

Notice

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Contents

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injuries or damages to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only specified by this manual.

◆ The reparation could only be executed by professional authorized personnel.

◆ Avoid fire and personal injury.

◆ Use Proper Power Cord.

◆ Ground the Instrument.

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

◆ Observe all Terminal Ratings.

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

◆ Do Not Operate Without Covers.

Do not operate the instrument with covers or panels removed.

◆ **Avoid Circuit or Wire Exposure.**

Do not touch exposed junctions and components when the unit is powered.

◆ **Do Not Operate With Suspected Failures.**

If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **AD INSTRUMENTS** authorized personnel.

◆ **Keep Well Ventilated.**

◆ **Do Not Operate in Wet Conditions.**

◆ **Do Not Operate in an Explosive Atmosphere.**

◆ **Keep Product Surfaces Clean and Dry.**

Model Number

The model in DSA2016TG/DSA2016 instrument

Instrument Model Number

Model No.	Spectrum Analyzer	TG
DSA2016TG	9 kHz to 1.6 GHz	5M-1.6G
DSA2016	9 kHz to 1.6 GHz	NO

Chapter1　Quick Start

◆ **[Instrument Introduction](#)**

◆ **[General Check](#)**

◆ **[Preparation](#)**

1.1 Instrument Introduction

DSA2016TG spectrum analyzers which are small, light and cost-effective, are portable spectrum analyzers designed for starters. Configured with easy-to-operate numeric keyboard, high-resolution color LCD display and various remote communication interfaces, they can be widely used in various fields, such as education, company research and development as well as industrial manufacture.

Main features:

- Frequency Range: 9 kHz to 1.6GHz
- Displayed Average Noise Level (DANL): -135 dBm (Typical)
- Phase Noise: -80 dBc/Hz @ 10 kHz offset
- Total Amplitude Accuracy: <1.5 dB
- Minimum Resolution Bandwidth (RBW): 100 Hz
- VSWR Measurement Kit (Option)
- Standard with Preamplifier
- 5.7 inche (600×480 pixels) high-definition display with clear, vivid, and easy-to-use graphical interface
- Various interfaces such as LAN, USB Host, USB Device

1.2 General Inspection

1. Inspect the shipping container for damage

Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has passed both electrical and mechanical tests.

2. Inspect the instrument

In case of any damage, or defect, or failure, notify the AD INSTRUMENTS representative.

3. Check the accessories

Please check the accessories according to the packing lists. If the accessories are incomplete or damaged, please contact the AD INSTRUMENTS representative.

1.3 To Prepare for Use

This chapter introduces the basic process to help you fast start to use the instrument.
Prepare the instrument.

1. To Connect to Power

Please use the power cord provided with the accessories to connect the spectrum analyzer to AC power source.

Press the power switch on lower left of front pannel to turn on the instrument.

2. Power-on Inspection

After connecting the instrument to power source correctly, press at the front panel to start the spectrum analyzer. Following the start-up screen which shows the start-up initialization process information, the sweep curve is displayed.

Chapter2   Operating Basics

◆ **Front Panel Menu Reference**

◆ **Top Panel**

◆ **Side Panel**

◆ **User Interface**

◆ **Menu Operation**

◆ **Parameter Setting**

2.1 Front Panel

2.1.1 Menu Reference

1. LCD
2. Menu softkeys/menu control keys
3. Charge indicator (Only lights up when charging)
4. Knob
5. Direction keys
6. Numeric Keyboard
7. Power switch (Lighting-normal work status)
8. Function key area
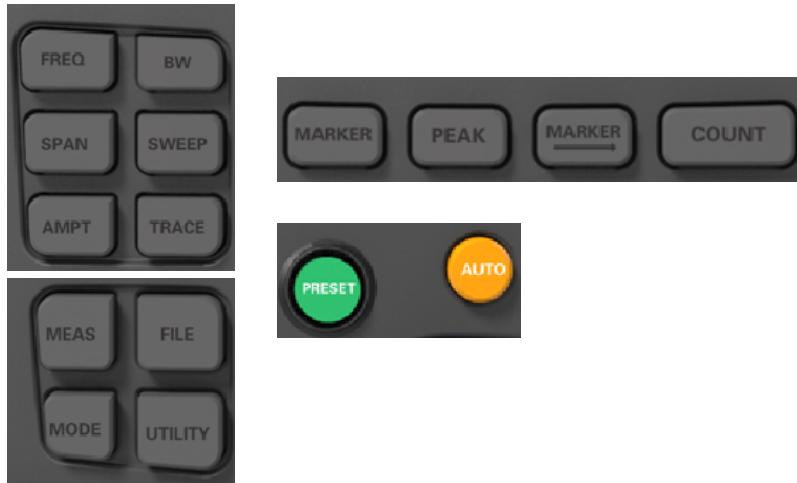
2.1.2 Front Panel Function Keys

FREQ: Set the center, start and stop frequency; enable the signal tracking function.

SPAN: Set the frequency span of the sweep.

AMPT: Set the reference level, RF attenuator, scale and the unit of Y-axis, etc. Set the reference level offset, maximum mixing level and input impedence. Execute auto scale and auto range as well as turn on the RF preamplifier.

BW: Set the resolution bandwidth (RBW) and video bandwidth (VBW). Select average type.

SWEEP: Set the sweep and trigger parameters.

TRACE：Set the parameters related to trace and filter types.

MEAS: Select and control the measurement function

MODE：Select mode

FILE：Save files

UTILITY：Auxiliary function

MARKER：Read the amplitude, frequency and sweep time of a certain point on the trace.

PEAK：Open the peak search menu and search for peaks immediately.

MARKER：Set other system parameters on the basis of the current marker value.

COUNT: Frequency counter function

PRESET: Restore the system to factory settings or user-defined state.

AUTO: Search for signals automatically within full frequency range.

2.1.3 Numeric Keyboard

DSA2016TG provides a numeric keyboard at the front panel (as shown in the figure below). The numeric keyboard which supports the Chinese characters, numbers and common symbols (including decimal point, and -) are mainly used to edit file or folder name.

The numeric keyboard consists of the following parts:

1.

- The input mode is fixed at number input during parameter setting. During parameter setting, press this key to input the symbol ("-") of the figure. When the key is pressed for the first time, the parameter symbol is "-".
- Press to switch among Chinese, English and number input during file or folder name editing.

2. Number/Letter

- Multiplexing keys for numbers and letters. They are used to directly input the desired number or letter.
- 0 is the multiplexing key for 0. Press this key to input 0 in number input.

3.

- Press this key to input a decimal point at the current cursor position in number input.

4. ENTER

- When pressed during parameter editing process, the system will complete the input and insert a default unit for the parameter automatically.
- While in the process of file name editing, this key is used to input the character currently selected by the cursor.

5. ESC CANCEL

- During parameter editing process, press this key to clear the inputs in the active function area and exit parameter input.
- While in the process of file name editing, press this key tol delete characters that have been entered.
- Press this key to turn off the display of the active function area when the main measurement screen is displayed.
- Press this key to exit the current test mode in keyboard test.
- Press this key to unlock the screen when it is locked.

6. BACK

- During the process of parameter editing, press this key to delete the character on the left of the cursor.
- While in the process of file name editing, press this key to delete the character on the left of the cursor.

2.2 Top Panel

1. **RF OUT Connector:** The output for the built-in tracking generator. Enabled with Option TG3.
2. **EXT TRIG IN/REF IN (BNC, Female):** Connects to an external TTL signal or a 10 MHz reference signal. The TTL signal is used to the analyzer's internal sweep.
3. **RF IN Connector (50 Ω):** Accepts an external input with a frequency range from 100 kHz to 3 GHz(1.6GHz), tunable to 9 kHz.

2.3 Side Panel

2.3.1 Right Panel

Right Panel
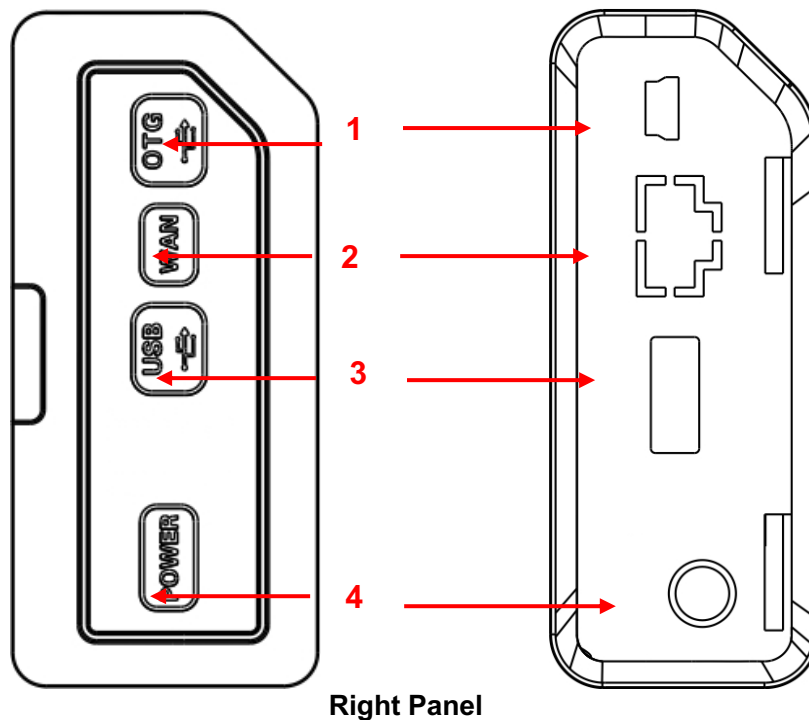
1. USB interface (Device)

   Connects to a PC

2. WAN Interface

   Connects to a PC for SCPI remote control

3. USB interface (Host)

   Connects to a USB memory stick or disk

4. External DC power connector

   Provides input for the DC power source via an AC-DC adapter, or Automotive type DC adapter

2.3.2 Left Panel
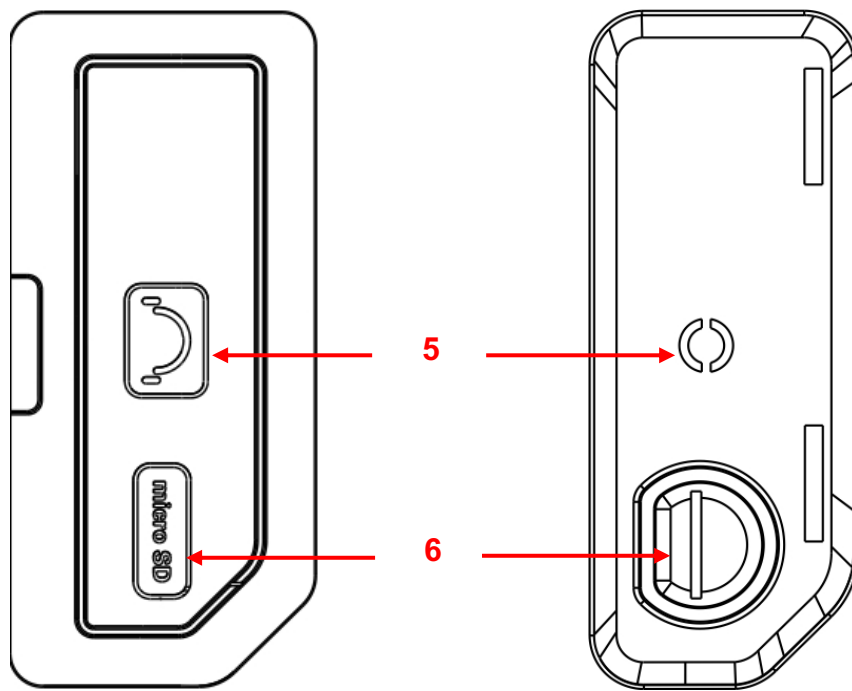
Left Panel

5. Headphone Connects to a headphone
6. SD card slot

2.4 User Interface
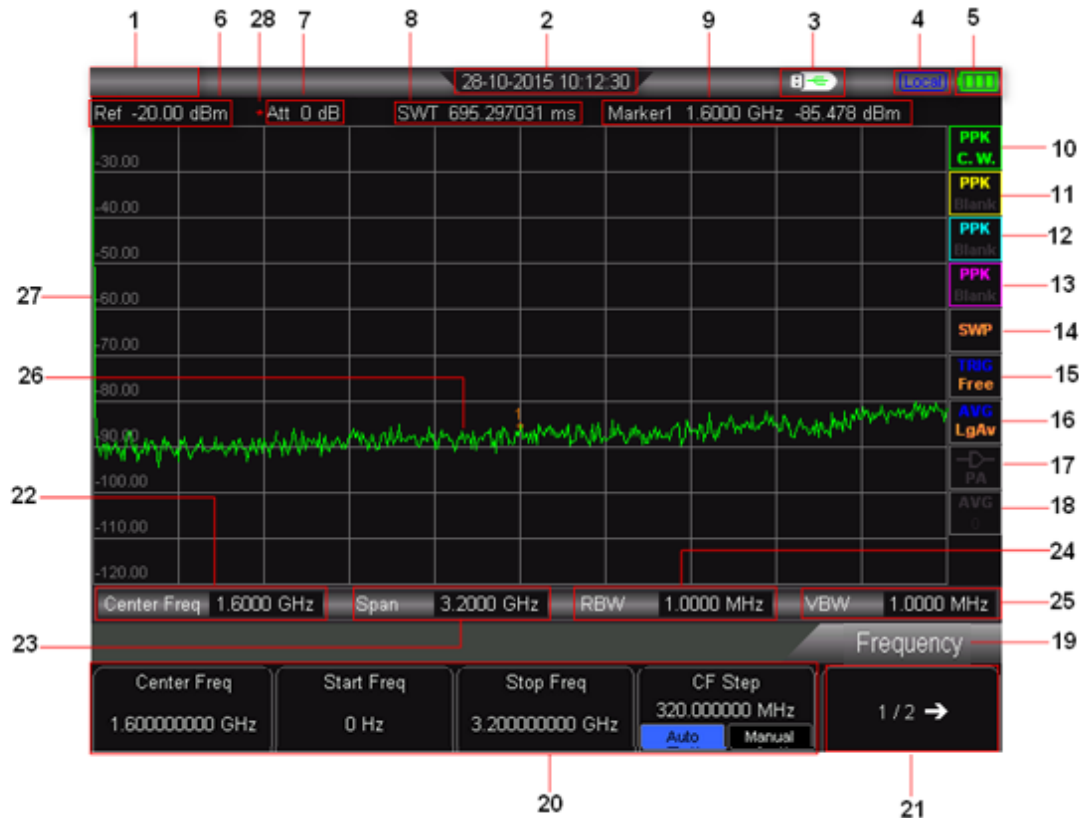
User interface:

1. Reserved

2. Time: System time

3. USB storage device status: ▢ is displayed when USB storage device is installed.

4. Operation status: Display "Local" (in local mode) or "Rmt" (in remote mode).

5. Power display

6. Reference level：Reference level value

7. Attenuator settings: Attenuator settings

8. SWT Value

9. Marker value：

   Cursor X: Current X value of the cursor. Note that X indicates different physical quantities in different functions.

   Cursor Y: Current Y value of the cursor. Note that Y indicates different physical quantities in different functions.

10. Trace 1 Detector type: Normal, Pos peak, Neg peak, Sample, RMS Avg.

11. Trace 2 Detector type: Normal, Pos peak, Neg peak, Sample, RMS Avg.

12. Trace 3 Detector type: Normal, Pos peak, Neg peak, Sample, RMS Avg.

13. Trace 4 Detector type: Normal, Pos peak, Neg peak, Sample, RMS Avg.

14. Sweep mode: Continuous or Single sweep (with current number of sweeps)

15. Trigger type: Free.

16. Average type: Average type in BW, logarithmic power, power, voltage.

17. Preamplifier status: Enable or disable the preamplifier.

18. Average times: Average times of trace.

19. Menu title: Function of the current menu.

20. Menu items: Menu items of the current function.

21. Menu page number：Show the total number of pages and current page number.

22. Center frequency: The frequency range of the current sweep channel can be expressed by a combination of center frequency and span or a combination of start frequency and stop frequency.

23. Span: The frequency range of the current sweep channel can be expressed by a combination of center frequency and span or a combination of start frequency and stop frequency.

24. RBW：Resolution bandwidth.

25. VBW：Video bandwidth.

26. Spectrum line display area: Spectrum line display area.

27. Y scale: Label of Y scale.

28. Manual setting: The corresponding parameter is in manual setting mode.

2.5 Menu Operation

There are 6 types of menus according to their operation modes. Each type of menu and its operation method are introduced below.

1. Parameter Input
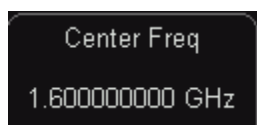
When selected, use the numeric keys to modify the parameters directly. For example, select "Center Freq", input the desired figure and select proper unit to change the center frequency.

2. State Switching

Press the corresponding menu key to switch between the sub-options. For example, press "Signal Track" to enable or disable the signal tracking function.

3. Enter Lower Menu (with parameter)

Press the corresponding menu key to enter the lower menu and change the option currently selected.
For example, press "AMPT" to enter the lower menu. Select dBm and return to the previous menu. The unit of Y-axis changes to dBm.

4. Enter Lower Menu (without parameter)

Display ▶
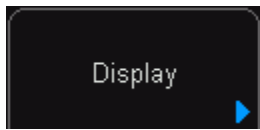
Press the corresponding menu key to enter the lower menu. For example, press "**Corrections"** to enter directly.

5.Function Switch + Parameter Input

CF Step
320.000000 MHz
Auto | Manual

Press the corresponding menu key to switch between functions; change the parameter directly using the numeric keys.
For example, press "CF Step" to switch between "Auto" and "Manual"; if "Manual" is selected, you can directly input the desired number to change the CF Step.

6. State Selection
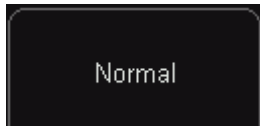
Normal

Press the corresponding menu key to modify the parameter and return to the menu one level up. For example, press "MARKER" "NORMAL" to select normal state. It means "MARKER" is in normal state.

2.6 Parameter Setting

Users can enter the desired parameter values using the numeric keys, knob, or direction keys. This section describes the three methods of parameter setting through an example (to set the center frequency to 800 MHz).

1. Use the numeric keyboard

    1) Press "FREQ"→Center Freq;
    2) Input "800" using the numeric keys;
    3) Select "MHz" by selecting the desired unit from the popup menu.

2. Use the knob

When the parameter is editable (namely when the parameter is selected), turn the knob clockwise to increase or counterclockwise to decrease the parameter value at specified step.
1) Press "**FREQ**" →Center Freq;
2) Rotate the knob until the parameter is set to a certain value (800 MHz).

3. Use the direction keys

When the parameter is editable (namely when the parameter is selected), you can increase or decrease the parameter value at specific step using the direction keys.
1) Press "**FREQ**" →Center Freq;
2) Press up/down direction key until the parameter is set to a certain value (800 MHz).

Note: in the storage function, the direction keys can also be used to select the current path or file.

Chapter3　Basic Settings

This chapter describes in detail the function keys at the front panel and the associated functions.

Subjects in this chapter:

- ◆ **[Basic Settings](#)**

- ◆ **[Sweep and Function Settings](#)**

- ◆ **[Marker Measurements](#)**

- ◆ **[Shortcut Key](#)**

3.1 Basic Settings

3.1.1 FREQ

Set the frequency parameters of the analyzer. The analyzer sweeps within a specified frequency range, and the sweep is restarted every time you change the frequency parameters.

The frequency range of a channel can be expressed by either of two groups of parameters: Start Frequency and Stop Frequency(f_{start}/f_{stop}); or Center Frequency and Span(f_{center}/ f_{span}). If any of the parameters is changed, the others would be adjusted automatically in order to ensure the coupling relationship among them:

$$f_{center} = \left(f_{stop} + f_{start} \right) / 2$$

$$f_{span} = f_{stop} - f_{start}$$

Center Freq

Set the center frequency of the current channel. Press this key to switch to center frequency input mode and the center frequency is displayed at the lower left and right sides of the grid respectively.

Key Points:

- The start and stop frequencies vary with the center frequency when the span is constant.
- Changing the center frequency horizontally shifts the current channel and the adjustment is limited by the specified frequency range.
- In Zero Span mode, the start frequency, stop frequency and center frequency are always the same.
- You can modify this parameter using the numeric keys, knob or direction keys. Refer to "**Parameter Setting**" for more details.

Center Frequency

Parameter	Explanation
Default	1.6GHz (1.6GHz)
Range*	0 Hz to 1.6GHz (1.6GHz)
Unit	GHz, MHz, kHz, Hz
Knob Step	Span > 0, step = Span/200 Span = 0, step = RBW/100 Min = 1 Hz
Direction Key Step	CF step

*Note: The range is from 50 Hz to [1.6GHz (1.6GHz)-50 Hz] in non-zero span.

Start Freq

Set the start frequency of the current channel. Press this key to switch to start/stop frequency input mode and the start and stop frequencies are displayed at the lower left and right sides of the grid respectively.

Key Points:

- The span and center frequency vary with the start frequency. The change of span would affect other system parameters. For more details, please refer to "**Span**".

- In Zero Span mode, the start frequency, stop frequency and center frequency are always the same. If one is changed, the others are updated to match.
- You can modify this parameter using the numeric keys, knob or direction keys. Refer to "**Parameter Setting**" for more details.

Start Frequency

Parameter	Explanation
Default	0 GHz
Range*	100 Hz to 1.6GHz (1.6GHz)
Unit	GHz, MHz, kHz, Hz
Knob Step	Span > 0, step = Span/200 Span = 0, step = RBW/100 Min = 1 Hz
Direction Key Step	CF step

*Note: The range is from 0 Hz to (1.6GHz (1.6GHz)-100 Hz) in non-zero span.

Stop Freq

Set the stop frequency of the current channel. Press this key to switch to start/stop frequency input mode and the start and stop frequencies are displayed at the lower left and right sides of the grid respectively.

Key Points:
- The span and center frequency vary with the stop frequency. The change of span would affect other system parameters. For more details, please refer to "**Span**".
- You can modify this parameter using the numeric keys, knob or direction keys. For more details, please refer to "**Parameter Setting**".

Stop frequency

Parameter	Explanation
Default	1.6GHz (1.6GHz)
Range*	100 Hz to 1.6GHz (1.6GHz)
Unit	GHz, MHz, kHz, Hz
Knob Step	Span > 0, step = Span/200 Span = 0, step = VBW/100 Min = 1 Hz
Direction Key Step	CF step

*Note: The range is from 100 Hz to 1.6GHz (1.6GHz) in non-zero span.

CF Step

Set the step of center frequency. Changing the center frequency in a fixed step continuously switches the channel to be measured. **Key Points:**
- The CF step can be set in "Manual" or "Auto" mode. In Auto mode, the CF step is 1/10 of the span in Non-zero span mode or equals the RBW while in Zero span mode; in Manual mode, you can set the step using the numeric keys.
- After you set an appropriate CF step and select **Center Freq**, use up and down direction keys to switch between measurement channels in a specified step in order to sweep the adjacent channel manually.
- You can modify this parameter using the numeric keys, knob or direction keys. For more details, please refer to **"Parameter Setting"**.

CF step

Parameter	Explanation
Default	320 MHz
Range	1 Hz to 1.6GHz (1.6GHz)
Unit	GHz, MHz, kHz, Hz
Knob Step	Span > 0, step = Span/200 Span = 0 , step = 100 Hz Min = 1 Hz

Direction Key Step	in 1, 2, 5 sequence

3.1.2 SPAN

Set the span of the analyzer. The change of this parameter will affect the frequency parameters and restart the sweep.

Span

Set the frequency range of the current channel. Press this key to switch to center frequency/span input mode and the center frequency and span are displayed at the lower left and right sides of the grid respectively.

Key Points:
- The start and stop frequencies vary with the span automatically.
- In manual span mode, the span can be set down to 100 Hz (the only way into the zero-span mode is pressing the **Zero Span** menu option) and up to the full span described in "**Specifications**". When the span is set to the maximum, the analyzer enters full span mode.
- Modifying the span in non-zero span mode may cause an automatic change in both CF step and RBW if they are in Auto mode, and the change of RBW may influence VBW (in Auto VBW mode).
- Variation in the span, RBW or VBW would cause a change in the sweep time.
- You can modify this parameter using the numeric keys, knob, or direction keys. For more details, please refer to "**Parameter Setting**".

Span **Parameter**	**Explanation**
Default	1.6GHz (1.6GHz)
Range*	0 Hz to 1.6GHz (1.6GHz)
Unit	GHz, MHz, kHz, Hz
Knob Step	Span/200, Min = 1 Hz
Direction Key Step	in 1, 2, 5 sequence

*Note: 0 Hz is available only in zero span.

Full Span

Set the span of the analyzer to the maximum.

Zero Span

Set the span of the analyzer to 0 Hz. Both the start and stop frequencies will equal the center frequency and the horizontal axis will denote time. The analyzer measures the time domain characteristics of the amplitude of the corresponding frequency point on the input signal. **Key Points:** As opposed to the Non-zero span, the screen shows the time domain characteristics of the fixed frequency component in zero span mode.The following functions are invalid in Zero span mode:

"Zoom In" and "Zoom Out" in SPAN

Zoom In

Set the span to half of its current value. At this point, the signal on the screen is zommed in on to observe signal details.

Zoom Out

Set the span to twice the current value. At this point, the signal on the screen is zoomed out on to

gain more information about the signal.

3.1.3 AMPT

Set the amplitude parameters of the analyzer. Through modifying these parameters, signals under measurement can be displayed in a proper mode for easier obsercation and minimum error.

Ref Level

Set the maximum power or voltage can be currently displayed in the window and the value is displayed at the upper left corner of the screen grid. **Key Points:**

*   The maximum reference level available is affected by the maximum mixing level, input attenuation and preamplifier. When you adjust it, the input attenuation is adjusted under a constant maximum mixing level in order to fulfill the following inequality:

$$L_{\text{Ref}} - a_{RF} + a_{PA} \leq L_{mix}$$

L_{Ref}, a_{RF}, a_{PA} and L_{mix} denote the reference level, the input attenuation, the preamplifier and the maximum mixing level respectively.

*   You can modify this parameter using the numeric keys, knob or direction keys. For more details, please refer to "**Parameter Setting**".

Reference level

Parameter	Explanation
Default	20 dBm
Range	-100 dBm to 30 dBm
Unit	dBm, -dBm, mV, uV
Knob Step	in Log scale mode, step = Scale/10 in Lin scale mode, step = 0.1 dBm
Direction Key Step	in Log scale mode, step = Scale in Lin scale mode, step = 1 dBm

Input Atten

Set the front attenuator of the RF input in order to ensure big signals (or small signals) to pass from the mixer with low distortion (or low noise).

Key Points:

*   When the preamplifier is On, the input attenuation could be set up to 30 dB. You can adjust the reference level to ensure that the specified parameter meets the inequality L_{Ref} $-a_{RF} + a_{PA} \leq L_{mix}$.

*   You can modify this parameter using the numeric keys, knob or direction keys. For more details, please refer to "**Parameter Setting**".

Input attenuation

Parameter	Explanation
Default	40 dB
Range	0 dB to 30 dB
Unit	dB
Knob Step	1 dB

Direction Key Step	5 dB

Scale/Div

Set the logarithmic units per vertical grid division on the display. This function is only available when the scale type is set to "Log".
Key Points:
•   By changing the scale, the amplitude range available is adjusted.

Scale Type

Set the scale type of Y-axis to Lin or Log, the default is Log. **Key Points:**
•   In Log scale type: the Y-axis denotes the logarithmic coordinate, the value shown at the top of the grid is the reference level and each grid represents the scale value. The unit of Y-axis will automatically switch to the default "dBm" in Log scale type when the scale type is changed from Lin to Log.
•   In Lin scale type: the Y-axis denotes the linear coordinate, the values shown at the top of the grid and the bottom of the grid are the reference level and 0 V respectively. Each grid represents 10% of the reference level and the Scale/Div is invalid. The unit of Y-axis will automatically switch to the default "Volts" in Lin scale type when the scale type is changed from Log to Lin.
•   The scale type does not affect the unit of Y-axis.

Units

Set the unit of the Y-axis to dBm, dBmV, dBuV, Volts or Watts. Wherein, dBm, dBmV, and dBuV are for Log scale; Volts and Watts are for Linear scale. The default is dBm.
Key Points:
The conversion relationships between units:

$$dBm \ = \ 10\log\left(\frac{Volts^2}{R} \times \frac{1}{0.001W}\right)$$

$$dBuV \ = \ 20\log\left(\frac{Volts \times 10^6}{1uV}\right)$$

$$dBmV \ = \ 20\log\left(\frac{Volts \times 10^3}{1mV}\right)$$

$$Watts \ = \ \frac{Volts^2}{R}$$

Wherein, R denotes the reference resistance.

Ref Offset

Assign an offset to the reference level to compensate for gains or losses generated between the device under measurement and the analyzer.
Key Points:
The change of this value changes both the reference level readout and the amplitude readout of the marker, but does not impact the position of the curve on the screen.
You can modify this parameter using the numeric keys. For more details, please refer to "**Parameter Setting**".

Reference level offset

Parameter	Explanation
Default	0 dB
Range	-300 dB to 300 dB
Unit	dB
Knob Step	N/A
Direction Key Step	N/A

RF Preamp

Set the status of the preamplifier located at the front of the RF signal path. Turning on the preamplifier reduces the displayed average noise level in order to distinguish small signals from the noise when the signal under measurement is small.

Key Points:

The corresponding icon will be displayed in the status bar at the left side of the screen when the preamplifier is On.

Scale Value

Scale Value is on the left of display area. Select "ON", display. Select "OFF", do not display.

3.2 Sweep and Function Settings

3.2.1 BW

Set the RBW (Resolution Bandwidth), VBW (Video Bandwidth) and detector type parameters of the analyzer.

RBW

Set the desired resolution bandwidth in order to distinguish between signals which are close in frequency.

Key Points:

• Reducing RBW will increase the frequency resolution, but will increase the sweep time (Sweep Time is affected by a combination of RBW and VBW when it is in Auto mode).

• RBW decreases with the span (non-zero span) in Auto RBW mode.

• You can modify this parameter using the numeric keys, knob or direction keys. For more details, please refer to "**Parameter Setting**".

Note: if detector type is "Quasi-Peak" or filter type is "EMI", RBW can be 200 Hz, 9 kHz or 120 kHz only.

RBW (Filter Type is Gauss)

Parameter	Explanation
Default	1 MHz
Range	100 Hz to 1 MHz
Unit	GHz, MHz, kHz, Hz
Knob Step	in 1, 3, 10 sequence
Direction Key Step	in 1, 3, 10 sequence

Video Bandwidth

Set Video Bandwidth, shortform is VBW, to filter the noise out of the video band.

Key Points:

• Reduce VBW can make the spectral line be smooth, and the small signal which is submerged in noise can stand out. But the scan time will be longer. (When scan time is automatic, it is influenced by RBW and VBW together).

• When VBW is automatic, it changes with RBW. But it is not influenced by RBW when manually.

• You can use numeric keys, knobs or direction keys to modify this parameter. The detail method refers to the specification in "Parameter Setting".

VBW Reference

Parameter	Instruction
Default	1 MHz
Range	1 Hz to 1 MHz
Unit	GHz, MHz, kHz, Hz
Knob Step	in 1, 3, 10 sequence
Direction Key Step	in 1, 3, 10 sequence

V/R Ratio

Set the ratio of VBW and RBW.

Key Points:

• Choose the ratio according to different signals:

• When measure sine signals, normally choose 1~3 (to get shorter scan time). When measure pulse signals, choose 10 (to reduce the influence to the amplitude of nstantaneous signal). When measure noise signals, normally choose 0.1 (to get the average value of noise).

• You can use numeric keys, knobs or direction keys to modify this parameter. The detail method refers to the specification in "Parameter Setting".

V/R Ratio Reference

Parameter	Instruction
Default	1 MHz
Range	0.000001 ~ 30000
Unit	N/A
Knob Step	in 1, 3, 10 sequence
Direction Key Step	in 1, 3, 10 sequence

3.2.2 Sweep

Set parameters about the Sweep and Trigger functions, including Time, Auto SWT, Mode, Numbers, Trigger type, etc.

Mode

Set the sweep mode to "Single" or "Continue", the default is "Continue". The corresponding icon of the sweep mode will be displayed in the status bar at the left side of the screen.

1. Single

Set the sweep mode to "Single". The number **10** on the parameter icon denotes the current sweep number.

2. Continue

Set the sweep mode to "Cont". The character **Continue** on the parameter icon denotes the analyzer is sweeping continuously.

Key Points:

- If the instrument is in single sweep mode and no measurement function is enabled, press this key and the system will enter the continuous mode and sweep continuously if all the trigger conditions are satisfied.
- If the instrument is in single sweep mode and a measurement function is on, press this key and the system will enter the continuous sweep mode and measure continuously if all the trigger conditions are satisfied.
- In continuous mode, the system will send a trigger initialization signal automatically and enter the trigger condition judgment directly after each sweep.

Single

In single sweep mode, this menu is used to execute trigger initialization. After that, the analyzer will execute specified number of sweeps (or measurements) if all the trigger conditions are satisfied.

Key Points:

- If the instrument is in continuous sweep mode and no measurement function is enabled, press this key and the system will enter the single sweep mode and execute specified number of sweeps if all the trigger conditions are satisfied.
- If the instrument is in continuous sweep mode and a measurement function is on, press this key and the system will enter the single measure mode and execute specified number of measurements if all the trigger conditions are satisfied.
- If the system is already in single sweep mode, press this key and the system will execute specified number of sweeps (or measurements) if all the trigger conditions are satisfied.

3.2.3 Trace

The sweep signal is displayed as a trace on the screen.

Select Trace

This series allows for up to four traces to be displayed at the same time, and each trace has its own color. All traces can be set freely except Trace 4 (a math operation trace that can only be obtained using the other three traces). Select Trace 1, Trace 2 or Trace 3 to set the corresponding parameters. The default trace and type is Trace 1 and Clear Write.

Trace Type

Set the type of the current trace or disable it. The system calculates the sample data using a

specific operation method according to the trace type selected and displays the result. Trace types contain Clear Write, Max Hold, Min Hold, Video Avg, Power Avg and Freeze. The corresponding icon of the trace type will be displayed in the status bar at the left of the screen. Take Trace 1 (Green) as an example and the icons are as shown in the figure below.

1. Clear Write
The trace continuously displays the points during the sweep of the analyzer.

2. Max Hold
Maintain the maximum for each point of the trace, and update the trace point if a new maximum is generated in successive sweeps.

3. Min Hold
Maintain the minimum for each point of the trace, and update the trace point if a new minimum is generated in successive sweeps.

4. Freeze
Stop updating the trace data to observe the trace and read the measurement data. This type is generally used by traces loaded from storage devices or remote interface as default.

5. Blank
Disable the trace display and all measurements of this trace.

Average Times
Set the number of averages of the selected trace.
Key Points:
• More averages can reduce the noise and the influence of other random signals, thus highlighting the stable signal characteristics. The larger the number of averages is, the smoother the trace will be.
• You can use the numeric keys to modify this parameter, please refer to "**Parameter Setting**" for more details.

Average times

Parameter	Explanation
Default	100
Range	1 to 1000
Unit	N/A
Knob Step	N/A
Direction Key Step	N/A

Clear All
Clear all the traces displayed on the screen. This operation will stop the current advanced measurement as there is not valid data source.

3.3 Marker Measurement

Marker

Marker is a diamond-shaped marker (As shown below), to mark the point in trace. Through the marker, you can read amplitude, frequency or the time point of scan on each point.

Keypoints:
- It can show four pairs of marker on time at the most, but there is only one pair or one single marker which is in activated status each time.
- You can use numeric keys, knobs or direction keys to modify this parameter. The detail method refers to the specification in "Parameter Setting".

1. Marker

Choose one of four markers, the default one is the first. After choosen, you can set the mode of marker, trace that is marked, reading method and other parameters. The marker which is opened currently should be marked on the trace chosen by marker trace. The reading on the marker from which is in activated status currently is shown on the right corner of the screen in active function area.

Marker Paremeter

Parameter	Instruction
Default	Center Frequency
Range	0 ~ 1.6GHz (1.6GHz)
Unit	Reading = Frequency (or period), unit is GHz, MHz, kHz, Hz (or ks, s, ms, us, ns, ps) Reading = Time (or reciprocal of time), unit is ks, s, ms, us, ns, ps (or GHz, MHz, kHz, Hz)
Knob Step	Reading = Frequency (or period), Step = Sweeping width/(sweep point - 1), Reading = Time (or reciprocal of time), Step = Sweeping time/(sweep point – 1)
Direction Key Step	Reading = Frequency (or period), Sweeping width/10 Reading = Time (or reciprocal of time), Step = Sweeping time/10

2. Normal

One type of marker, used for measuring X value (frequency and time) and Y value (amplitude) of one point on the trace. When choose "Normal", there will be a marker marked by the current marker on the trace, like "1".

Keypoints:
- If there is no active marker, then you need to activate a marker in center frequency of current trace.
- Move the marker through inputing value by numberic keys, knobs or direction keys. The reading of current marker is shown on the right corner of screen.
- The resolution of reading on X-axis (frequency or time) is related with sweep width. Reduce the sweep width can get higher resolution.

3. Off

Close the marker chosen currently, and the marder information and relative function shown in the screen will be closed too.

4. Marking trace

Choose the trace marking by current marker as 1, 2, 3, 4.

5. Readout

Set the reading method of marker X-axis, each marker can be set different reading type. This set only change the method of reading, not actual value. This set will influence the marker reading in active function area and the corner of screen.

a) Frequency

"Normality" marker shows absolute frequency when choose this type of reading method. "Difference Value", "Difference Value Pair" and "Span Pair" marker shows the frequency difference of reference marker relative to differenct value marker. In the mode of non-zero sweeping width, the default reading method is "Frequency".

b) Period

"Normality" marker shows the reciprocal of marker frequency, when choose this type of reading method. "Difference Value", "Difference Value Pair" and "Span Pair" marker shows the reciprocal of frequency difference. When frequency difference is zero, the reciprocal is infinity. The reading is shown as ＞100Ts. This reading method can not be used in the mode of zero sweeping width.

c) Time Difference

"Normality" marker shows the time difference before the marker and the start of sweeping when choose this type of reading method.. "Difference Value", "Difference Value Pair" and "Span Pair" marker shows the sweeping time difference between differenct value marker and reference marker. The default reading method is "Time" in the mode of zero sweeping width.

6. All Off

Close all the markers which has been open and its realitive function.

Marker->

Use current marker value to set other system parameter of equipment (like center frequency, reference level, etc.). If there is no marker open, press **Marker ->** and activate a marker automativly.

1. Center Frequency

Set center frequency of spectrum analyzer as the frequency of current marker.

- Center frequency is set as the frequency of marker when choose normality marker.
- Center frequency is set as the frequency of difference value marker when choose difference value, difference value pair and span pair marker.
- This function is invalid in the mode of zero sweeping width.

2. Intermediate Frequency Step

Set intermediate frequency step of spectrum analyzer as the frequency of current marker.

- Intermediate frequency step is set as the frequency of marker when choosing normality marker.
- Intermediate frequency step is set as the frequency of difference value marker when choosing difference value, difference value pair and span pair marker.
- This function is invalid in the mode of zero sweeping width.

3. Start Frequency

Set start frequency of spectrum analyzer as the frequency of current marker.

- Start frequency is set as the frequency of marker when choosing normality marker.
- Start frequency is set as the frequency of difference value marker when choosing difference value, difference value pair and span pair marker.
- This function is invalid in the mode of zero sweeping width.

4. Stop Frequency

   Set stop frequency of spectrum analyzer as the frequency of current marker.

   • Stop frequency is set as the frequency of marker when choosing normality marker.

   • Stop frequency is set as the frequency of difference value marker when choosing difference value, difference value pair and span pair marker.

   • This function is invalid in the mode of zero sweeping width.

5. Reference Line

   Set reference level of spectrum analyzer as the frequency of current marker.

   • Reference level is set as the amplitude of marker when choosing normality marker.

   • Reference level is set as the amplitude of difference value marker when choosing difference value, difference value pair and span pair marker.

Peak

Open the setting menu of peak search, and excute the peak search function.

Keypoints:

• When choose "Max" in the option of Search Parameter　Peak Search, it means to look up the maximum value on the trace and mark with marker.

• When choose "Parameter" in the option of Search Parameter　Peak Search, it means to look up the peak value that meets the search parameter on the trace and mark with marker.

• The peak value search of next peak, right peak and left peak should meet the condition of search parameter.

• When it can not find the peak meets the condition, it shows "No peak is found" in the screen.

1. **Next Peak**

   Looking up the peak which amplitude is just second to current peak and meets the search condition on the trace and marking with marker.

2. **Peak Right**

   Looking up the peak which is on the right side of current peak and the nearest peak that meets the search condition on the trace and marking with marker.

3. **Peak Left**

   Looking up the peak which is on the left side of current peak and the nearest peak that meets the search condition on the trace and marking with marker.

4. **Min Search**

   Looking up the minimum amplitude value on the trace and marking with marker.

5. **Peak-Peak Search**

   Execute peak search and minimum search at the same and mark with "difference value pair" marker. Including, the peak search result is marked with difference value marker. The minimum search result is marked with reference marker.

6. **Continuous Search**

   Open or close continuous search. The default is close. When open continuous search, the spectrum analyzer execute peak search once automaticly for tracking measurement signals after the end of each sweeping.

   The difference between continuous peak and signal tracking: Continuous peak always looks up maximum value in current frequency channel. Signal tracking always tracks the signal which has equal amplitude on the marker position before open this function, and set the frequency of corresponding signals as center frequency.

7. **Search Parameter**

Define the condition of peak search to search all kinds of peak. It can only be judged as peak when meanwhile meets the value of both "peak excursn" and "peak thresh".

1) Peak Excursn

Specify the difference value between peak and minimum amplitude on left and right side. The difference value which is higher than peak excursn can be judged as peak.

Parameter	Instruction
Default	10 dB
Range	0 dB ~ 200 dB
Unit	dB
Knob Step	1 dB
Direction Key Step	1 dB

2) Peak thresh

Specify the minimum value of peak amplitude. The peak which is higher than peak thresh can be judged as peak.

Parameter	Instruction
Default	-90 dB
Range	-200 dBm ~ 0 dBm
Unit	dBm,-dBm,mV,uV
Knob Step	1 dBm
Direction Key Step	1 dBm

3) Peak Search

Set the peak which is looked up in peak search is whether the maximum value on the trace or the peak meets search parameter.

•   Choose "Max Value", then look up the maximum value on the trace.

•   Choose "Parameter", then look up the peak meets the condition of search parameter on the trace.

•   This set is only valid for the peak search excecuted when press "Peak".

3.4 Shortcut Key

3.4.1 Auto

Search for signals automatically throughout the full frequency range and adjust the frequency and amplitude for optimum display effect of the signal, thus realizing one-key signal search and auto setting of parameters.

Before Auto Search**:**
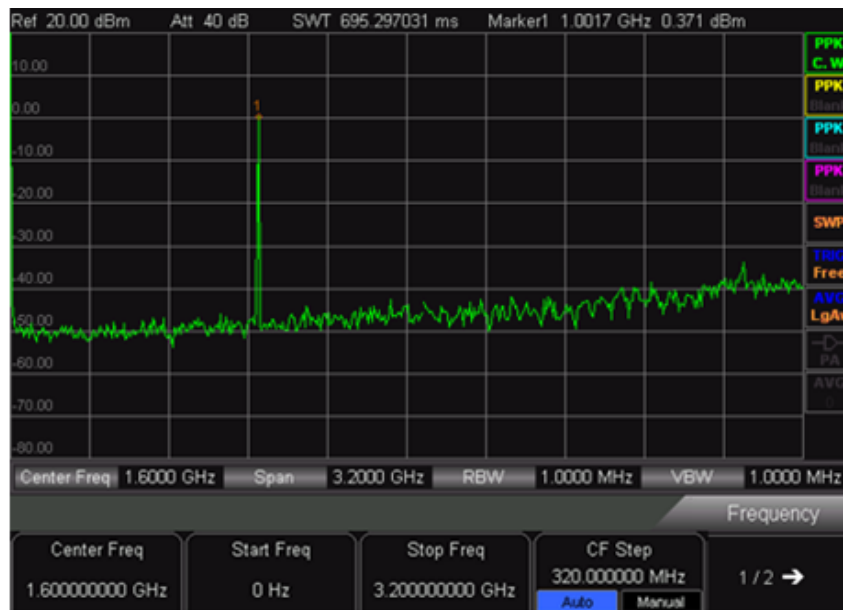
After Auto Search**:**
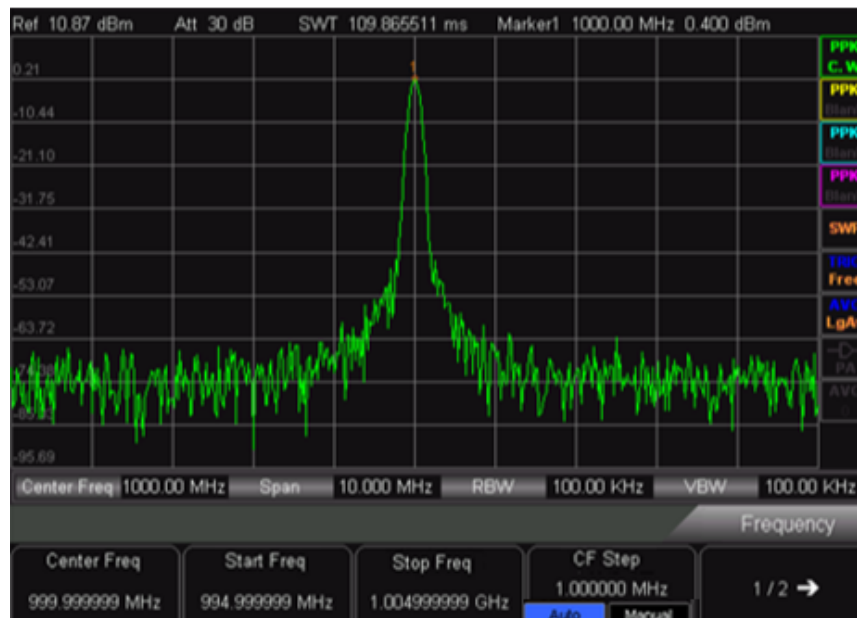
Key Points:

- In the process of auto search, the backlight of **Auto** turns on and "Auto Tune" is shown in the status bar on the screen until the search is finished.
- Some parameters such as the reference level, scale, input attenuation and maximum mixing level may be changed during the auto search.

3.4.2 Preset

Recall the preset setting and restore the analyzer to a specified status.
Key Point:

◆ Press **Preset** to load the factory settings listed in the following table (except items marked with "******") or User-defined settings.

Parameter	Default

Frequency	
Center Freq	1.6GHz (800MHz)
Start Freq	0 Hz
Stop Freq	1.6GHz (1.6GHz)
CF Step	Auto,150 MHz
Span	
Span	1.6GHz (1.6GHz)
Amplitude	
Ref Level	40 dBm
Ref Offset	20 dB
Scale/Div	5/DIV
Input Atten	Auto,40 dB
Scale Type	Log
Unit	dBm
RF Preamp	Off
BW	
RBW	Auto, 1 MHz
VBW	Auto, 1 MHz
V/R Ratio	1
Sweep	
Time	Auto,690 ms
Auto SWT	Normal
Trace	
Select Trace	1
Trace Type of Trace 1	Clear Write
Avg Times	10
Measure*	
Meas Fctn	Off
Marker	
Select Mkr	1
Mkr Type	Normal
Delta Pair	Delta
Span Pair	Center
Mkr Table	Off
Peak	
Cont Peak	Off
Peak Search	Max
Pk Excursn	10 dB
Pk Thresh	-90 dBm

3.4.3 Utility

Set the system parameters

1. Save

Press this key can save the screen as picture into U-stick.

2. Language

This series supports multi-language menu. Press this key to select the desired display language.

3. Display

Control the screen display of the analyzer, such as setting the graticule brightness, screen state, brightness.
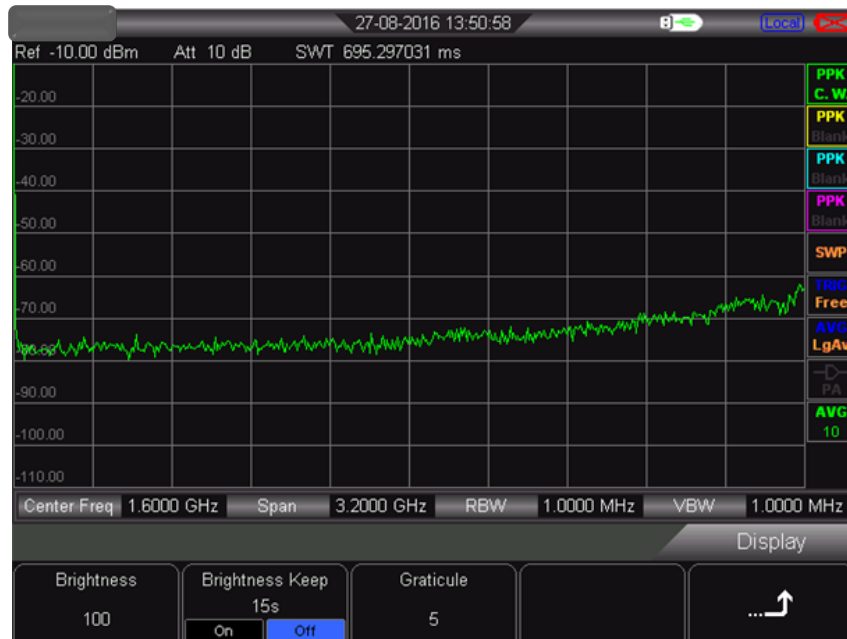
◆ Brightness

Set the LCD brightness of the analyzer. Default is 100.
You can modify this parameter using the numeric keys, knob or direction keys.

◆ Backlight Keeping

Set the On/Off status of backlight, default is "Off" 15s. It can be changed between On and Off.

◆ Graticule

Set the brightness of the grid to highlight the display of the trace.
You can modify this parameter using the numeric keys, knob or direction keys.

4. Setting

This series spectrum analyzer can set reference clock, key tone, power by USB when shut down.
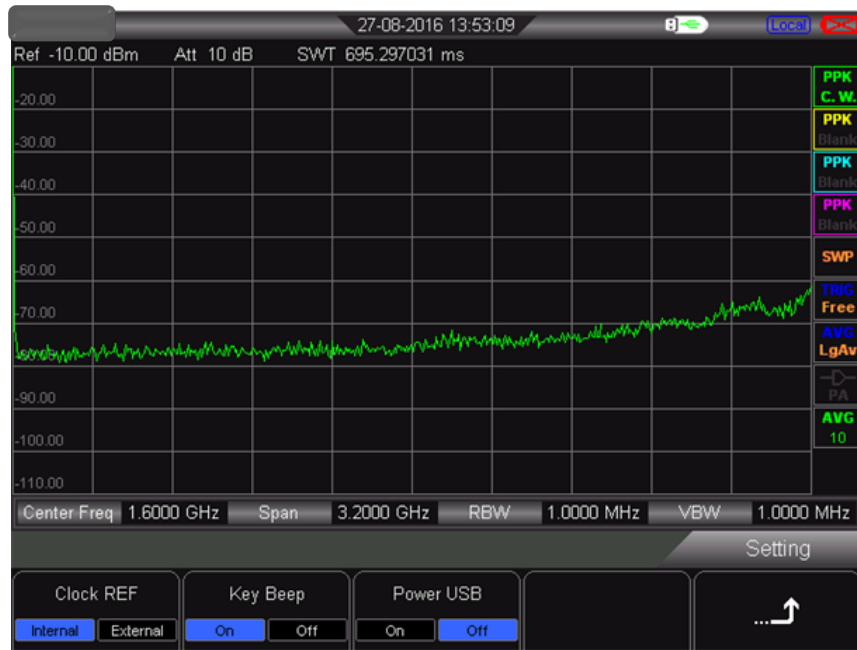
◆ Reference Clock

   DSA2016TG provides internal clock or external clock. User can select the internal or external clock sourse directly. Default is internal clock.

◆ Keytone

   It can be turn on or off.

◆ Power by USB when shut down

   User can select whether it will still be powered by USB after shuting down.

5. Remote Control

Users can control this sesies spectrum analyzer through USB or LAN remote interface.

◆ Remote Communication

   Select to use LAN or USB interface, or close them all.

6. Power On/Preset

Power On/Preset includes power on, preset type, save as user. The user can set the power-on status according to the requirement.

◆ Power on

   The user can select power-on status as the last time or preset. The preset content refers to preset type.

◆ Preset Type

   The preset type includes Default, User, Last time. Default is the parameter of factory setting. User is the parameter that is saved by the user manually. Last time is the paremeter setting status that the user power off the equipment last time.

◆ Save User

   User can save the parameter of spectrum analyzer according to the requirement manully.
   Press "Save User", then it shows "saved".

7. Time/Date

The system time is displayed in "hh:mm:ss YYYY-MM-DD" format in the DSA800 user interface. The output file can include the time information when printing or storing interface image according to your setting.

◆ **Set Time**

Set the display time of the analyzer. The time format should be hhmmss, for example, 231211 (denotes 23:12:11).

◆ **Set Date**

Set the display date of the analyzer. The date format should be YYYYMMDD, for example, 20111001 (denotes October 1st, 2011).

8. Diagnostics

◆ **Screen Test**

Test whether the screen has a dot defect using five colors: White, Red, Green, Blue and Black.

◆ **Key Test**

Enter the keyboard test interface. Press the function keys at the front panel one by one and observe whether the corresponding key lights. If not, an error may have occurred in that key. Note if the key at the front panel is transparent, its backlight will also light when you press it. To exit the test, press **Esc** three times.

9. Update

User can update firmware. Plug in the U-stick within latest firmware file, the instrument will detect it. Click **UTILITY**→update→firmware.

10. System Information

User can get the instrument information clearly. Click **UTILITY** → SYSTEM INFORMATION. It includes firmware version, temperature, operation time of this time, power voltage.

Chapter4 Test Case

◆ Testing Low Level Signal

◆ Testing Signal Distortion

4.1 Testing Low Level Signal

This section introduces how to test low level signal, and how to differentiate it with the noice in the same spectrum. The following is three methods to test low level signal.

4.1.1 Reduce the Loss of Input

The ability of spectrum analyzer to test low signal is limited by the noice produced internally. The level is influenced by input attenuator when signal passes the spectrum analyzer. If the signal is very close to the bottom of noise, it can differentiate the signal with the noice to reduce the loss of input.

1) Reset spectrum analyzer

2) Set the frequency of signal source and amplitude as 1 GHz and -80 dBm. Connect the RF OUT port of signal source to the RF IN port of spectrum analyzer and turn on the signal output.

3) Set center frequency, span and reference level:

- Press FREQ → 1GHz
- Press SPAN → 5MHz
- Press AMPT→ - 40dBm

4) Move the peak value that needed to the center of screen.

- Press MARKER → Peak
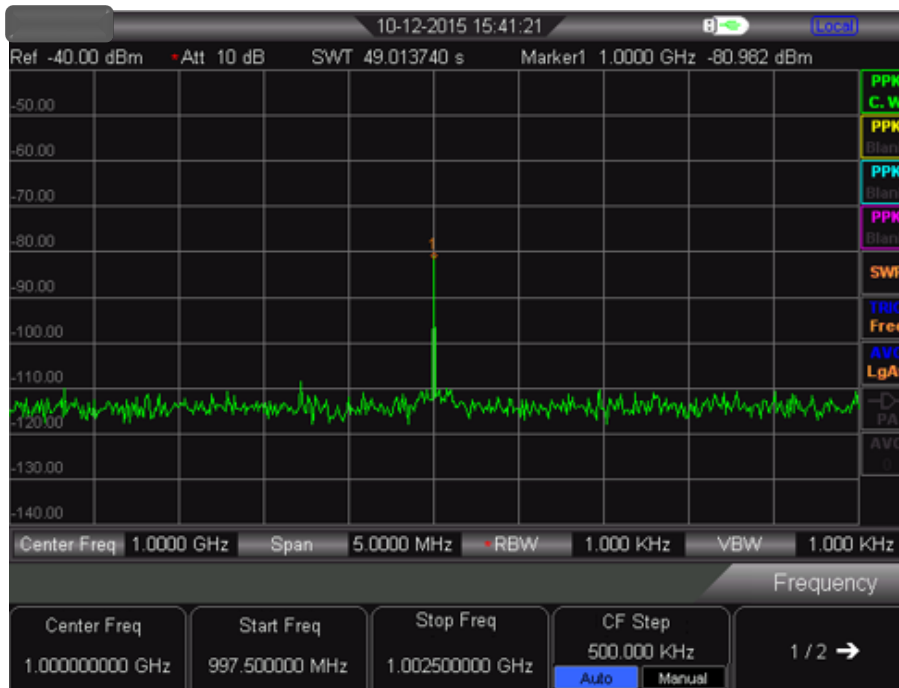
1) Reduce the span to 1 MHz. If need, move the peak value to the center of screen again.

- Press SPAN →1 MHz

2) Set the attenuation as 20 dB. Pay attention that when the attenuation increases, the bottom of noice will be more close to signal level.

- Press AMPT→Attenuation→ 20dB
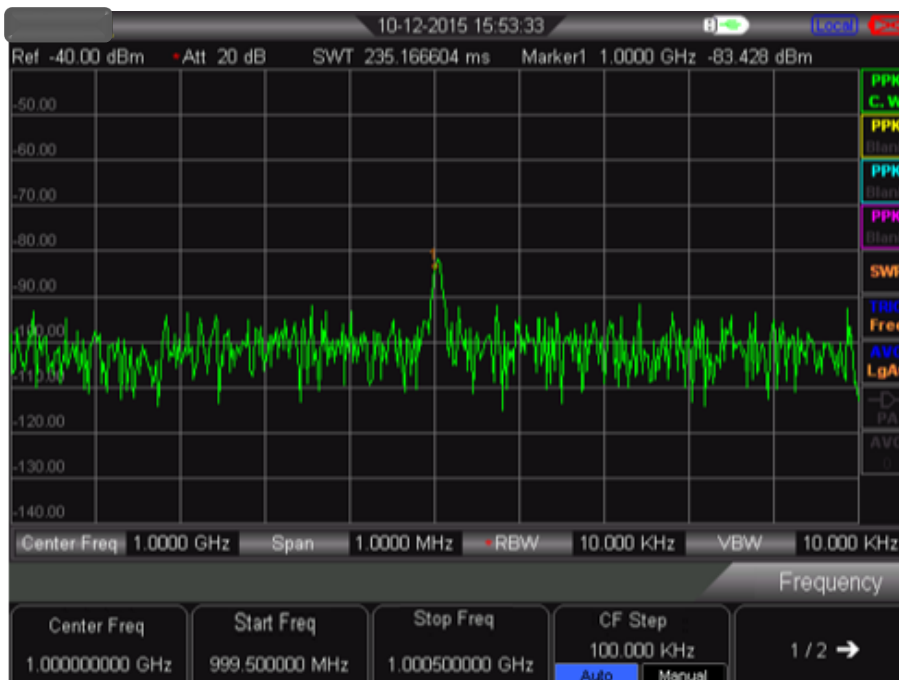
3) Press AMPT →Attenuation→ 0 dB, set the attenuation as 0 dB.
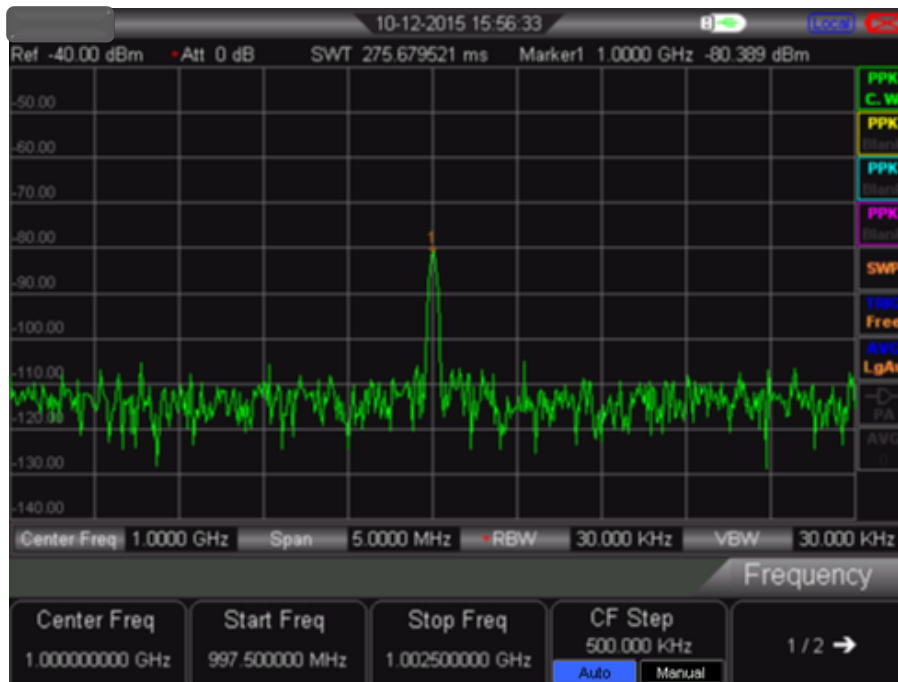
4.1.2 Reduce the Resolution Bandwidth

The internal noice level is influenced by resolution bandwidth, but continuous wave signal is not. Decrease RBW into 10%, and the bottom noise will also decrease 10 dB.

1) Reset spectrum analyzer

2) Set the frequency of signal source and amplitude as 1 GHz and -80 dBm. Connect the RF OUT port of signal source to the RF IN port of spectrum analyzer and turn on the signal output.

3) Set center frequency, span and reference level:
   - Press FREQ → 1GHz
   - Press SPAN → 5MHz
   - Press AMPT→ - 40dBm

4) Reduce resolution bandwidth.
   - Press BW, and press manual. The resolution bandwidth can be reduced by knobs and arrow key. Because the noise level reduces, the low level signal will be clearer, as following picture.
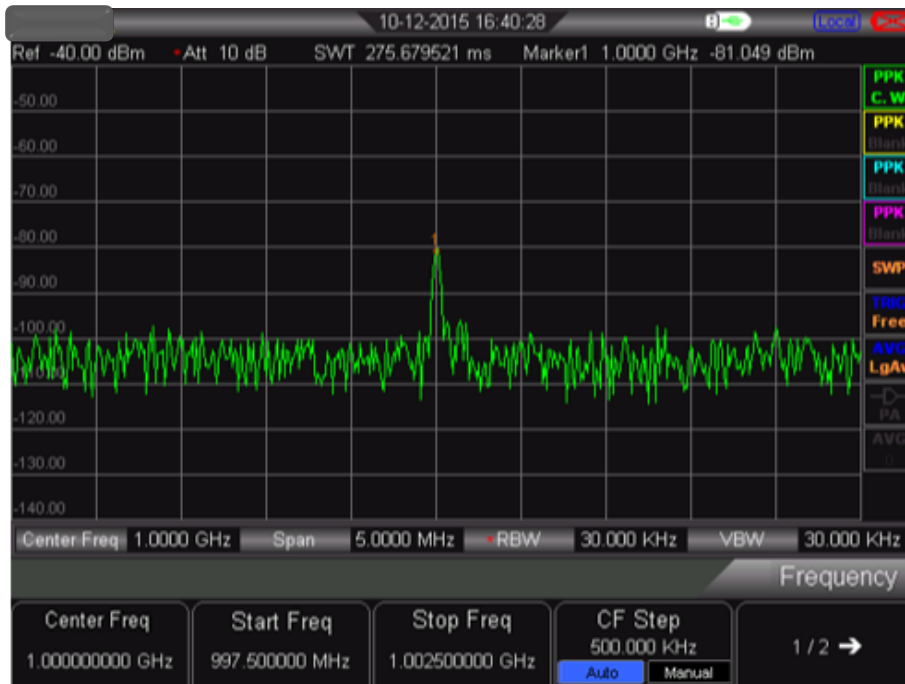
4.1.3 Trace Average

Taking the average is the digital processing. It is to plus current value in each trace point and previous average value, and then take the average. Choose the operation of taking average. When spectrum analyzer is doing the automatic coupling, it can make the displayed noise level get smooth to change detection mode into sampling mode.

1) Reset spectrum analyzer

2) Set the frequency of signal source and amplitude as 1 GHz and -80 dBm. Connect the RF OUT port of signal source to the RF IN port of spectrum analyzer and turn on the signal output.

3) Set center frequency, span and reference level:

   ● Press FREQ → 1GHz

   ● Press SPAN → 5MHz

   ● Press AMPT→ - 40dBm

4) Press TRACE →Average (ON) to turn on the average function.

   ● Press 100 → ENTER, set the number of average as 100. Because the operation of taking the average will make the trace be smooth, and the low level signal will be clearer.
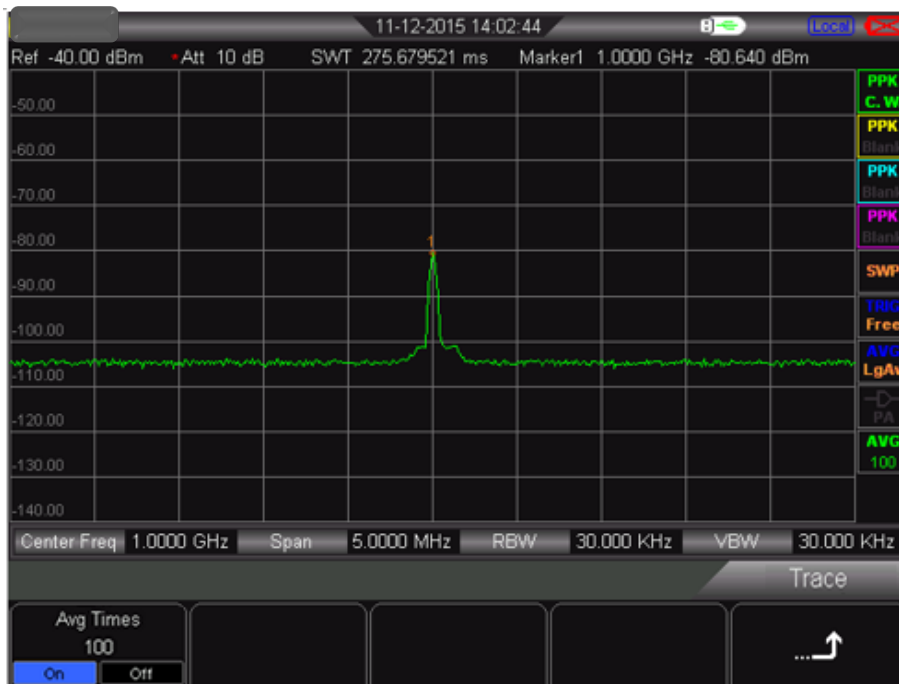
4.2 Measuring Signal Distortion

This selection introduces how to recognize and measure signal distortion.

Recognize the distortion produced by spectrum analyzer.

The high level input signal may cause the distortion signal produced by spectrum analyzer. This distortion signal will cover the true signal that needs to be measured in the input signal. The user can recognize these signals through trace and RF attenuator. If yes, this distortion is produced inside the instrument. In this case, we use a signal output by a function generator as signal source to recognize whether the harmonic distortion component is produced by spectrum analyzer.

1. Connect function generator to RF IN of spectrum analyzer. Set the input frequency and amplitude of signal source as 200MHz, -10dBm.
2. Set center frequency and span of spectrum analyzer.
   - Press [PRESET] (to restore factory settings) •
   - Press [FREQ] → 400MHz
   - Press [SPAN] → 700MHz

   The harmonic distortion component produced by this signal at the inputmixer of spectrum analyzer (arranged in turn with original 200MHz signal at 200MHz interval).
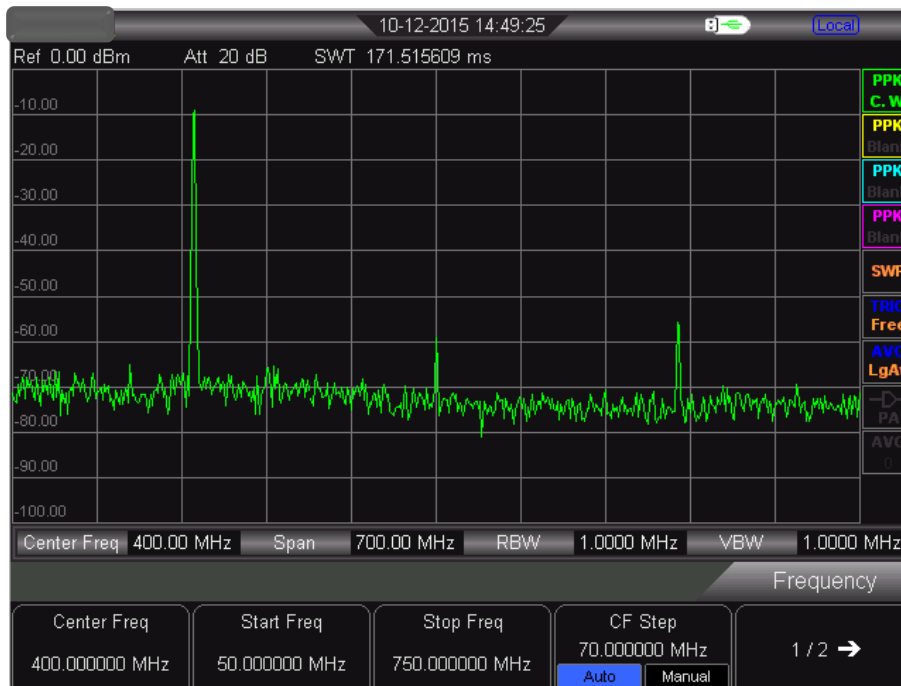
1. The center frequency should be changed as the frequency value at the first harmonic wave.

   ● Press [MARKER] → PEAK

2. Change the span as 50 MHz, and display the signal in the center of screen again.

   ● Press [SPAN] → 50MHz
   ● Press [MARKER] → PEAK

3. Set the attenuation as 0 dB：

   ● Press [AMPT] → Attenuation → 0dB

4. To recognize whether the harmonic distortion component is produced by spectrum analyzer, firstly display the input signal in trace 2：

   ● Press [TRACE] → Trace 2
   ● Press [TRACE] → Clear

5. Place a Delta mark in the harmonic distortion component of trace 2:
   ● Press [MARKER] → peak
   ● Press [MARKER] → Delta
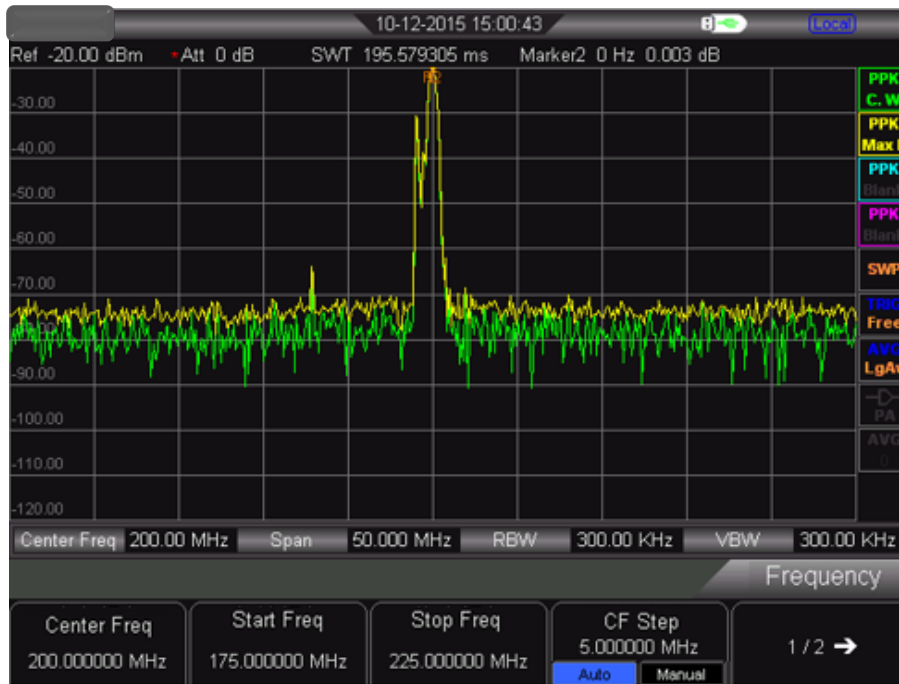
6. Press [AMPT] → Attenuation → 10dB to turn up the RF attenuation to 10 dB.

The reading of amplitude difference is influenced by two factors:

1) To increase input attenuation will make signal to noise ratio (SNR) worse which will cause the reading to be positive.

2) The loss of harmonic wave caused by internal circuit of spectrum analyzer will make the reading to be negative. To set the input attenuation can produce minimum reading.

Chapter5   SCPI Programme

User can control DSA2016TG spectrum analyzer by USB, LAN or remote interface. This manual to guide the user to use SCPI commands to control DSA2016TG spectrum analyzer by USB, LAN or remote interface.

Contents of this chapter：

◆ **SCPI Brief Introduction**

◆ **General Command**

◆ **CALCulate subsystem**

◆ **DEMOdulation subsystem**

◆ **DISPlay subsystem**

◆ **TRACe subsystem**

◆ **FORMat subsystem**

◆ **SENSe subsystem**

◆ **INITiate subsystem**

◆ **TRIGger subsystem**

◆ **UNIT subsystem**

◆ **SYSTem subsystem**

5.1 SCPI Brief Introduction

SCPI (Standard Commands for Programmable Instrument) is an ASCII- based instrument command language designed for test and measurement instruments, with the goal of reducing automatic test equipment (ATE) program development time. SCPI accomplishes this goal by providing a consistent programming environment for instrument control and data usage. This consistent programming environment is achieved by the use of defined program messages, instrument responses, and data formats across all SCPI instruments. By providing a consistent programming environment, replacing one SCPI instrument with another SCPI instrument in a system should require less effort than with non- SCPI instrument.

SCPI is not a standard which completely provides for interchangeable instrumentation. SCPI helps move toward interchangeability by defining instrument commands and responses, but not functionality, accuracy, resolution, and so forth.

5.1.1 Basic Knowledge Requirement

Programming with SCPI requires knowledge of:
*   Computer programming languages, such as C or C++.
*   The language of your instrument. A HAS Series spectrum analyzer employs SCPI as its programming language.SCPI.

5.1.2 Command Syntax

Command syntax includes standard notations and statement rules.

Command Statement Rules Overview
*   Command statements read from left to right
*   Use either long form or short form of keywords, but do not use both
*   No separating space between the keywords, only use a colon to separate keywords of different levels
*   Always separating a keyword from a variable with a space
*   Always separating a variable from its unit with a space (if variable has a unit)

5.1.3 Standard Notations

A command consists of mnemonics (keywords), parameters and punctuation. Before you start to program your analyzer, familiarize yourself with the standard notation of each of them.

Keywords

Many commands have both a long and a short form: use either one. (a combination of the two is not allowed). Consider the: FREQuency command for example:
*   Short form : FREQ
*   Long form : FREQuency

SCPI is not case sensitive, so fREquEncy is just as valid as FREQUENCY, but FREQ and FREQUENCY are the only valid forms of the FREQuency command. In this documentation, upper case letters indicate the short form of the keyword. The upper case and lower case letters indicate the long form of the keyword.

5.1.4 Punctuation

- A curly brackets "{ }" indicates a variable parameters to be defined.
- A vertical bar "|" dictates a choice of one element from a list. For example: <A>|<B> indicates that either A or B can be selected, but not both.
- Square brackets "[ ]" indicates that the enclosed items are optional.
- Angle brackets "< >" indicates a variable value to be defined.
- A question mark "?" after a command indicates that this command is a query. The instrument should return a data to the controller

5.1.5 Separator

- A colon ":" separates keywords of different hiberarchy.
- A space separates a keyword and a parameter, as well as a parameter and a unit.

5.1.6 Default unit of parameters

The analyzer has the following default units for numeric variables.

Parameter	Default unit
Frequency	Hz
Amplitude	dBm
Time	uS

5.2 Common Commands

IEEE 488.2 common commands is mainly used to operate or query the status register.

5.2.1 Clear Status

Command format:
   *CLS
Function description:
   This command clears the error queue of the analyzer.

5.2.2 Identification Query

Command format:
   *IDN?
Function description:
This command returns an instrument identification information string. The response is organized into four fields by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number
- Firmware version

5.2.3 Reset

Command format:
  *RST
Function description:
  This command returns the instrument to a factory defined condition that is appropriate for remote programming operation.

5.2.4 ABORt Command

Command format:
  :ABORt
Function description:
  Give up the current operation. Restart the sweep.

5.3 CALCulate Subsystem

5.3.1 CALCulate: MARKer Subsection

- **Markers All Off on All Traces**
  Command format:
    :CALCulate:MARKer:AOFF
  Function description:
  This command turns off all markers on all traces.

- **Turn on or off COUNT**
  Command format:
    CALCulate:MARKer:FCOunt[:STATe] OFF|ON|0|1
  Function description:
  Turn on or off the COUNT function

- **Query frequency values of COUNT**
  Command format:
    CALCulate:MARKer:FCOunt:X?
  Function description:
  Query frequency values of COUNT, unit is Hz.

- **Set mark as current mark**
  Command format:
    CALCulate:MARKer:CURrent 0|1|2|3
  Function description:
  Set mark as current mark, easy for control.

- **Set measurement type of current mark**
  Command format:
    CALCulate:MARKer:MODE OFF|POSition|DELTa|BAND|SPAN
    CALCulate:MARKer:MODE?

Function description:

Set measurement type of current mark

Query measurement type of current mark

Parameter specification：

OFF: Turn off current cursor

POSition: to set measurement type as Normal

DELTa: to set measurement type as Different value

BAND: to set measurement type as Band

SPAN: to set measurement type as Span

Return format：

Query return to POS,DELT,BAND,SPAN or OFF

- **Marker Peak Left Search**
   Command format:

   CALCulate:MARKer:MAXimum:LEFT

   Function description:

   Search a peak which is the nearest on the left of current peak and meets the search condition, and mark with current cursor.

   Instruction

   "No peak is found" will be displayed on the screen when there is no approperate peak been found.

- **Marker Peak Right Search**
   Command format:

   CALCulate:MARKer:MAXimum:RIGHt

   Function description:

   Search a peak which is the nearest on the right of current peak and meets the search condition, and mark with current cursor.

   Instruction

   "No peak is found" will be displayed on the screen when there is no approperate peak been found.

- **Marker Peak Next Search**
   Command format:

   CALCulate:MARKer:MAXimum:NEXT

   Function description:

   Search a peak which amplitude is next only to current peak and meets the search condition, and mark with current cursor.

   Instruction

   "No peak is found" will be displayed on the screen when there is no approperate peak been found.

- **Execute peak search and mark once.**
   Command format:

   CALCulate:MARKer:MAXimum:MAX

   Function description:

   Execute peak search once as the setting of search mode, and mark it with current marker.

- **Check the minimum amplitude value on the trace.**
  Command format:
  CALCulate:MARKer:MINimum
  Function description:
  Check the minimum amplitude value on the trace, and mark it with current marker.
  Instruction
  It shows "No peak found" when can not find any peak.

- **Turn on or off the continuous peak search**
  Command format:
  CALCulate:MARKer:CPEak[:STATe] OFF|ON|0|1
  Function description:
  Turn on continuous peak search and mark the peak with current marker. Or turn off the continuous peak search.
  Instruction
  If there is no marker be turned on, it turns on Marker 1 automaticly and marks peak.

5.4 DEMOdulation Subsystem

5.4.1 AM Demodulation

Command format:
DEMod:AM:STATe OFF|ON|0|1
DEMod:AM:STATe?
Function description:
This command toggles AM demodulation function between on and off.
Check the on and off status of AM demodulation function.
Return format
Return 0 or 1

5.4.2 FM Demodulation

Command format:
DEMod:FM:STATe OFF|ON|0|1
DEMod:FM:STATe?
Function description:
This command toggles FM demodulation function between on and off.
Check the on and off status of FM demodulation function.
Return format
Return 0 or 1

5.5 DISPlay Subsystem

5.5.1 Trace Y-Axis Scaling

Command format:

DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_ampl>

DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Function description:

Set Y-Axis Scaling

Check Y-Axis Scaling

Parameter specification

rel_ampl, float data,range from 0.1 dB to 20 dB

Return format

Return Y-Axis Scaling as float data

5.5.2 Trace Y-Axis Reference Level

Command format:

DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <rel_ampl>

DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?

Function description:

Set reference level

Check reference level

Parameter specification

rel_ampl, float data, range from 100dBm to 30dBm.

Return format

Return reference level as float data

5.5.3 Trace Y-Axis Reference Level Offset

Command format:

DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>

DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?

Function description:

Set Y-Axis Reference Level Offset

Check Y-Axis Reference Level Offset

Parameter specification

rel_ampl, float data, range from -300dB to 300dB.

Return format

Return Y-Axis Reference Level Offset as float data

- **Vertical Axis Scaling**

Command format:

DISPlay:WINdow:TRACe:Y:SCALe:SPACing   LOG|LIN

DISPlay:WINdow:TRACe:Y:SCALe:SPACing?

Function description:

Set scale type

Check scale type
Parameter specification
LOG：Log
LIN: Line
Return format
Return LIN or LOG

5.6 TRACe Subsystem

5.6.1 Read appointed trace data

Command format:
TRACe[:DATA]:TRACE<n>?
Function description:
Read out appointed trace data from spectrum analyzer
Parameter specification
Value of n : 1|2|3|4
Return format
Return appointed trace data, its format depends on the set of commands:
FORMat:TRACe:DATA

5.6.2 Select trace display mode

Command format:
TRACE<n>:MODE WRITe|MAXHold|MINHold|FREEze|BLANk
TRACE<n>:MODE?
Function description:
Set appointed trace mode
Check appointed trace mode
Parameter specification
Value of n : 1|2|3|4
WRITe：Clear write
MAXHold: Maximum hold
MINHold：Minimum hold
FREEze：Review
BLANk：Close
Return format
Return WRITe, MAXHold, MINHold, FREEze, BLANk

5.6.3 Set trace average time

Command format:
TRACE<n>: AVERage:COUNt <int_avg>
TRACE<n>: AVERage:COUNt?

Function description:

    Set appointed trace average time

    Check appointed trace average time

Parameter specification

    Value of n : 1|2|3|4

    int_avg, integral data,range from 1 to 1000

Return format

    Return appointed trace average time

5.6.4 Set on/off of the average function in appointed trace.

Command format:

    TRACE<n>:AVERage 0|1

    TRACE<n>:AVERage?

Function description:

    Turn on or off the average function of appointed trace.

    Check the on/off status of average function in appointed trace.

Parameter specification

    Value of n: 1|2|3|4

Return format

    Check and return the on(1)/off(0) status of average function in appointed trace

5.6.5 Clear all trace

Command format:

    TRACe:CLEar:ALL

Function description:

    Clear all trace, means to set all trace type as BLANK.

5.6.6 FORMat Subsystem

Set the return format of trace data.

Command format:

    FORMat:TRACe:DATA ASCii|REAL

    FORMat:TRACe:DATA?

Function description:

    Set the return format of trace data.

Parameter specification

    ASCii: The data point is ASCII character, separated by comma.

    REAL: The data point is 32 bit binary number.

Return format

    Check and return ASCii or REAL

5.7 SENSe Subsystem

5.7.1 FREQuency Subsection

- **Set start frequency**
  Command format:
    SENSe:FREQuency:STARt <freq>
    SENSe:FREQuency:STARt?
  Function description:
    Set start frequency
    Query start frequency
  Parameter specification
    freq, integral data, range 0Hz to 1.6GHz
  Return format
    Query and return start frequency as an integer, unit is Hz.

- **Set center frequency**
  Command format:
    SENSe:FREQuency: CENTer <freq>
    SENSe:FREQuency: CENTer?
  Function description:
    Set center frequency
    Query center frequency
  Parameter specification
    freq, integral data, range 0Hz to 1.6GHz
  Return format
    Query and return center frequency as an integer, unit is Hz.

- **Set stop frequency**
  Command format:
    SENSe:FREQuency: STOP <freq>
    SENSe:FREQuency: STOP?
  Function description:
    Set stop frequency
    Query stop frequency
  Parameter specification
    freq, integral data, range 0Hz to 1.6GHz
  Return format
    Query and return stop frequency as an integer, unit is Hz.

- **Set span frequency**
  Command format:
    SENSe:FREQuency: SPAN <freq>
    SENSe:FREQuency: SPAN?
  Function description:
    Set span frequency
    Query span frequency

Parameter specification

freq, integral data, range 0Hz to 1.6GHz

Return format

Query and return span frequency as an integer, unit is Hz.

5.7.2 Span Mode

- **Set span mode**
  Command format:

  SENSe:FREQuency: SPAN FULL|PREVious|ZIn|ZOUT

  Function description:

  Set span mode

  Parameter specification

  FULL: Set as full span

  PREVious: Set as previous span

  ZIn: Zoom-in span

  ZOUT: Zoom-out span

5.7.3 Sweep

- **Query span time**
  Command format:

  SENSe:SWEep:TIME?

  Function description:

  Query span time

  Return format

  Query the span time returned as floating-point type data. Unit is us.

- **Set span mode**
  Command format:

  SENSe:SWEep:MODE NORMal|FAST

  SENSe:SWEep:MODE?

  Function description:

  Set span mode

  Query span mode

  Parameter specification:

  NORMal：Normal

  FAST: Fast span

  Return format

  Query and return NORMal or FAST

5.7.4 Detection

- **Set the type of detector**
  Command format:

  SENSe:DETector:TRACE<n>:FUNCtion NORMal|POSitive|NEGative|SAMPle|AVERage

  SENSe:DETector:TRACE<n>:FUNCtion?

Function description:

This command indicates detection mode. The detector will show every sampling everage in the interval between each trce. The everage will be achieved through the following two methods.

Power Methods (RMS)

Video Methods (Y-axis unit)

These two methods is controlled by trace detection.

Parameter specification

The value of n: 1|2|3|4

NORMal: normal

POSitive：positive value

NEGative：negative value

SAMPle：sampling

AVERage：average

Return format

Quary and return NORMal, POSitive, NEGative, SAMPle or AVERage.

5.7.5 Bandwidth

- **Set resolution bandwidth RBW**
  Command format:
  SENSe:BANDwidth:RESolution <freq>
  SENSe:BANDwidth:RESolution?
  Function description:
  Set resolution bandwidth (RBW)
  Query resolution bandwidth.
  Parameter specification
  freq, integral data, range from 10Hz to 1MHz.
  Return format
  Query and return the value of RBW as integral data format, unit is Hz.

- **Set resolution bandwidth RBW as AUTO mode**
  Command format:
  SENSe:BANDwidth:RESolution:AUTO OFF|ON|0|1
  SENSe:BANDwidth:RESolution:AUTO?
  Function description:
  Set resolution bandwidth RBW as AUTO mode.
  Query the status of resolution bandwidth AUTO mode.
  Return format
  Query and return the ON(1) or OFF(0) status of resolution bandwidth AUTO mode.

- **Set video bandwidth VBW**
  Command format:
  SENSe:BANDwidth: VIDeo <freq>
  SENSe:BANDwidth: VIDeo?
  Function description:
  Set video bandwidth (VBW).

Query vedio bandwidth.
Parameter specification
    freq, integral data, range from 1Hz to 1MHz.
Return format
    Query and return the value of video bandwidth (VBW) as integral data format, unit is Hz.

- **Set video bandwidth VBW as AUTO mode.**
  Command format:
      SENSe:BANDwidth: VIDeo:AUTO OFF|ON|0|1
      SENSe:BANDwidth: VIDeo:AUTO?
  Function description:
      Set video bandwidth (VBW) as AUTO mode.
      Query the status of video bandwidth AUTO mode.
  Return format
      Query and return the ON(1) or OFF(0) status of resolution bandwidth AUTO mode.

5.7.6 Average

- **Set average type**
  Command format:
      SENSe:BANDwidth:AVGType LOGPwr|POWEr|VOLTage
      SENSe:BANDwidth:AVGType?
  Function description:
      Set average type.
      Query average type.
  Parameter specification
      LOGPwr：ogarithmic power
      POWEr：power
      VOLTage：voltage
  Return format
      Query and return LOGPwr,POWEr or VOLTage.

5.7.7 Power

- **Set input attenuation**
  Command format:
      SENSe:POWer[:RF]:ATTenuation <rel_ampl>
      SENSe:POWer[:RF]:ATTenuation?
  Function description:
      Set the attenuation value of RF front-end attenuator.
      Query the attenuation value of RF front-end attenuator.
  Parameter specification
      rel_ampl, integral data, range from 0dB to 51dB.
  Return format
      Query input attenuation value, unit is dB.

- **Turn on or off the autoset of input attenuation**
  Command format:
  SENSe:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1
  SENSe:POWer[:RF]:ATTenuation:AUTO?
  Function description:
  Turn on or off the autoset of input attenuation.
  Query the autoset status of input attenuation.
  Return format
  Query and return the autoset on(1) or off(0) status of input attenuation.

- **Turn on or off the pre-amplifier**
  Command format:
  SENSe:POWer[:RF]:GAIN:STATe OFF|ON|0|1
  SENSe:POWer[:RF]:GAIN:STATe?
  Function description:
  Turn on or off the pre-amplifier
  Query the status of the pre-amplifier
  Return format
  Query and return the on(1) or off(0) status of the pre-amplifier

- **Autoset(AUTO)**
  Command format:
  SENSe:POWer:ATUNe
  Function description:
  Search signals in the full spectrum, and adjust the parameter of frequency and amplitude to the best status.

- **Turn on or off the function of high sensitivity**
  Command format:
  SENSe:HIGH:SENSitivity OFF|ON|0|1
  SENSe:HIGH:SENSitivity?
  Function description:
  Turn on or off the function of high sensitivity.
  Query the on/off status of high sensitivity.
  Return format
  Query and return the ON or OFF status as the format of characters.

5.8 INITiate Subsystem

5.8.1 Continuous Sweep and Single Sweep

Command format:
INITiate:CONTinuous OFF|ON|0|1
INITiate:CONTinuous?
Function description:

Turn on or off the function of continuous sweep. When continuous sweep is turned off, it enters into single sweep status.

Query the status of continuous sweep function.

Return format

Query and return the ON or OFF status of continuous sweep function as the format of characters.

5.8.2 Start Single Sweep

Command format:

INITiate:IMMediate

Function description:

This command is to start single sweep. Pay attention that this command is only valid after you set the sweep mode as single sweep in advance.

5.9 TRIGger Subsystem

5.9.1 Set Trigger Type

Command format:

TRIGger:SEQuence:SOURce IMMdeiate|VIDeo|EXTernal

TRIGger:SEQuence:SOURce?

Function description:

Set trigger type

Query trigger type

Parameter specification

IMMediate：Free trigger

VIDeo：Video trigger

EXTernal：External trigger

Return format

Query and reture IMMdeiate, VIDeo or EXTernal as the format of characters.

5.9.2 Edge Trigger of External Trigger

Command format:

TRIGger:SEQuence:EXTernal:SLOPe POSitive|NEGative

TRIGger:SEQuence:EXTernal:SLOPe?

Function description:

Set edge trigger of external trigger.

Query edge trigger of external trigger.

Parameter specification

POSitive：Rising edge

NEGative：Falling edge

Return format

Query and reture POSitive or NEGative as the format of characters.

5.9.3 Trigger Level in Video Trigger.

Command format:
TRIGger:SEQuence:VIDeo:LEVel <level>
TRIGger:SEQuence:VIDeo:LEVel?
Function description:
Set trigger level in video trigger.
Query trigger level in video trigger.
This command is only valid when select video trigger.
Parameter specification
level, floating-point data, range from -300.0dBm to 50 dBm.
Return format
Query and return trigger level value as the format of floating-point data.

5.9.4 UNIT Subsystem

- **Select the power unit used for measurement.**
  Command format:
  UNIT:POWer DBM|DBMV|DBUV|W|V
  UNIT:POWer?
  Function description:
  Set amplitude unit of Y-axis.
  Query amplitude unit of Y-axis.
  Return format
  Query and return DBM, DBMV, DBUV, W or V.

5.10 SYSTem Subsystem

5.10.1 Power off the Instrument.

Command format:
SYSTem:SHUTDOWN
Function description:
This command is to power off this spectrum analyzer.

5.10.2 Restart the Instrument

Command format:
SYSTem:RESTART
Function description:
This command is to restart the spectrum analyzer.

5.10.3 Preset

Command format:

SYSTem:PRESet

Function description:

This command makes the relevant setting of spectrum analyzer into preset status.

Chapter6   Specifications

This chapter lists the specifications and general specifications of the analyzer. All the specifications apply to the following conditions unless otherwise noted.
The instrument has been warmed-up for 30 minutes.
The instrument is within the calibration period and a self-calibration has been performed.

Typical value and nominal value are defined as follows.
Typical value: defined as the specifications of the product under specified conditions.
Nominal value: defined as the approximate quantity in the application of the product.

6.1 Technical Specifications

Parameters		
Model	DSA2016TG	
Frequency		
Frequency Range	9KHz~1.6HGz AC Coupled 5M~3GHz (1.6GHz) TG	
Frequency Resolution	1Hz	
Reference Frequency	10MHz	
Frequency Readout Accuracy	±(frequency indication*frequency reference uncertainty+1%*span+20%RBW+marker resolution+1Hz)	
Internal 10MHz Reference	Aging rate	±1ppm/year (0℃~50℃, Reference is 25℃)
Accuracy	Temperature stability	±1ppm
Marker Resolution	(Frequency span)/(number of sweep points-1)	
Resolution Bandwidth(RBW)		
-3dB Bandwidth	10Hz to 1MHz,1-3-10 sequence	
Accuracy	±5% RBW=10Hz~1MHz nominal	
Resolution Filter Shape Factor	＜5:1 nominal	
Video Bandwidth(VBW)	-3dB bandwidth	1Hz to 1MHz,1-3-10 sequence
	Accuracy	±10% VBM=1Hz~1MHz nominal
Displayed Average Noise Level (normalized to1Hz)		
9K~1MHz	Preamp off	-108dBm, typical -127dBm
1MHz ~10MHz		-128dBm, typical -146dBm
10MHz ~500MHz		-142dBm, typical -146dBm
500MHz ~2.5GHz(1.6GHz)		-141dBm, typical -145dBm
2.5GHz ~3GHz		-140dBm, typical -144dBm
9K~1MHz	Preamp on	-131dBm, typical -150dBm
1MHz ~10MHz		-148dBm, typical -163dBm
10MHz ~500MHz		-161dBm, typical -164dBm
500MHz ~2.5GHz(1.6GHz)		-159dBm, typical -162dBm
2.5GHz ~3GHz (3 Ghz version)		-158dBm, typical -161dBm
SSB Phase Noise		
Carrier Offset(20℃~	10K	< -92 dBc/Hz, typical -95 dBc/Hz
30℃,500MHz	30K	< -93 dBc/Hz, typical -96 dBc/Hz
	100K	< -95 dBc/Hz, typical -97 dBc/Hz
Central Frequency)	1MHz	< -117 dBc/Hz, typical -119 dBc/Hz
Sweep Time		
Range	Span >100Hz	2ms to 1000s
	Span=0Hz	600ns to 200s
Sweep Mode	Continuous, single	
Trigger Source	Free run; video; external	
Trigger slope	Selectable positive or negative edge	
Trigger delay	Span =0Hz	±12ms to ±12s nominal
Frequency Counter		
Counter Resolution	1Hz	
Accuracy	± (marker frequency × frequency reference uncertainty + counter resolution)	
Level Display Range		
Log Scale and Units	1 to 10 dB/divisions in 1, 2, 5, 10 dB steps, 10 divisions displayed	

Linear Scale and Units	0 to 100%, 10 divisions displayed	
Scale Unit	dBm, dBmV,dBuV,Watts,Volts	
Sweep (Trace) Points	461	
Number of Markers	4	
Detectors	Normal, positive peak, dample, negative peak, RMS	
Number of Traces	4	
Trace Functions	Clear/write, maximum hold, minimum hold, average, check,close	
Level Measurement Error	±1.5dB(excluding input VSWR mismatch) 20~30℃,peak detector, preamplifier off, input signal -50dBm to 0dBm	
Reference Level		
Setting Range	-100dBm to +30dBm, steps of 1dB	
Setting Resolution	Log scale	0.01dB
	Linear scale	Almost log(2.236µV to 7.07V)
Amplitude		
Maximum Safety Input Level	Average continuous power	+33dBm
	DC input voltage	50Vdc
Measurement Range	9KHz~2MHz	Displayed average noise level (DANL) to +10dB
	2MHz~3GHz (1.6GHz)	Displayed average noise level (DANL) to +20dB
	Input attenuator range	0 to 51dB,1dB steps
Spurious Response		
Second Harmonic Distortion(SHI)	<65dBc, 50MHz to 3GHz (1.6GHz) (Mixer level -30dBm, attenuator =0dB, preamp off, 20℃~30℃)	
Third-Order Intermodulation(TOI)	50~300MHz	+8dBm, Third-order intermodulation products: 2 x -20dBm; frequency separation 100KHz: attenuation = 0dB; preamp off, 20℃~30℃
	300MHz~3GHz(1.6GHz)	+10dBm
Input Related Spurious	<-75dBc, (input mixer = -30dBm)	
Inherent Residual Response	<-90dBm, typical -98dBm (Input terminated and 0 dB RF attenuation, preamplifier off)	
RF Input VSWR (at Tuned Frequency)	10MHz to 3GHz (1.6GHz)	＜1.5:1, nominal Attenuator setting 10~20dB
10MHz Reference/External Trigger Input		
Reference Iinput Frequency	10MHz	
Reference Input Amplitude	0~10dBm	
Trigger Voltage	5V TTL level	
Connector and Output Impendence	N female, (50Ω)	
Gennral Feature		
Interface Language	English, Chinese, Chinese Traditional	
Display Index	5.7 inch, 640*480 resolution, 64M color LCD display	
Temperature Range	Working	-10℃ to +50℃, (battery：0℃ to 50℃)
	Storage	-40℃ to +70℃, (battery :-20℃ to 50℃)
Relative Humidity	<95%	
Weight	2.9kg(with battery),2.6kg(without battery)	
Size	260m X 220m X 75m	

Power	Input voltage range	DC: 12-17V, maximum 2.8A input 220VAC±15%
	AC frequency range	40Hz to 60Hz
	Power consumption	Maximum 32W

Chapter7　Appendix

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Appendix A：Accessories

◆ Power: Input voltage range, AC 100 V to 240 V, standard value; AC frequency range 45 Hz to 440 Hz; Power consumption 35 W, typical value; All chosen work<50 W.

◆ Software installation CD, including PC communication software, which can easily transfer the data from spectrum analyzer to PC. There is also "User manual" in the CD.

Appendix B: Services and Support

Thank you for choosing AD INSTRUMENTS. Please contact us through the following ways should you have any inquiry regarding our products. We shall do our best to help you.

1. Contact your local AD INSTRUMENTS distributor;
2. Contact your local AD INSTRUMENTS field office;
3. Contact AD INSTRUMENTS headquarters in Spain.

Chapter8　General Care and Cleaning

8.1 General Care

Do not put or leave the device in a place where the LCD display will be exposed to direct sunlight for long periods of time.

Note: To avoid damage to the oscilloscope or probes, do not expose them to sprays, liquids, or solvents.

8.2 Cleaning

Examine the oscilloscope and probes as often as operating conditions require. To clean the exterior surface, perform the following steps:

1）Use a lint-free cloth to remove floating dust on the outside of the oscilloscope and probes. Take care to avoid scratching the glabrous display filter.

2）Use a soft cloth dampened with water to clean the oscilloscope. For more efficient cleaning, you may use an aqueous solution of 75% isopropyl alcohol.

Note: To avoid damage to the surface of the oscilloscope or probes, do not use any corrosive or chemical cleaning agents.