DS8821 SPECTRUM ANALYZER OPERATION MANUAL

Deviser Part No.: DK118208821
Version 2.28
Applicable models
DS8821 Serial Spectrum analyzer
Software version 2.28
Firmware version 1.28

Safety Summary

1. Safety Symbol

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and their meaning before operating this instrument.

CAUTION: The *caution* sign denotes a hazard. It calls attention to a procedure that if not correctly performed or adhered to could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

WARNING The *warning* sign denotes a hazard. It calls attention to a procedure that if not correctly performed or adhered to could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

2. Basic Precautions

Please observe the following precautions to prevent fire、burn、electric shock and personal Injury.

 ➢ Use a power cable rated for the voltage. Be sure however to use a power cable confirming to safety standards of your nation when using a product overseas. Do not place anything heavy on top of the power cable.
 ➢ When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
 ➢ When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not let the power cable pull out by itself. Make sure your hands are dry at this time.
 ➢ Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
 ➢ Be sure to plug the power cable into an electrical outlet, which has a safety round terminal. Grounding will be defeated if you use an extension cord which does not include a safety ground terminal.
 ➢ Do not use this instrument with the case open.
 ➢ Do not place objects on top of this product. Also do not place flowerpots or other containers containing liquid such as chemicals near this product.
 ➢ When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
 ➢ When using the product on a cart, fix it with belts to avoid its drop.
 ➢ When connecting the product to peripheral equipment, turn the power OFF.
 ➢ Don't throw the battery into the fire, or it'll explode.

Contents

Figure Index

1. Introduction

Main Points of This Chapter：

● **Prepare for use**

● **About the user manual**

● **ESD [Electrostatics Discharge]**

● **Technical support & other services**

1.1.Prepare for Use

1.1.1. Check the Instruments

Check the instrument after you unload it according to the following steps:

(1) Take out the instrument from the case and check it to make sure that there is no damage caused by transportation/shipment.

Unload the case carefully and check the package. If the package is in good condition, please save the package for later use. If the package is damaged, it indicates that the instrument must have felt heavy impact during the transportation. In such condition, you'd better keep the original state of the package and inform the freight Co. to inspect the instrument together according to the operation regulations introduced in this manual. You can claim damages to the freight Co. according to the damage station of the instrument and connect us to arrange the repair.

(2) Check all the accessories and data.

Check the accessories and data according to Table 1-1. The ordered options will be delivered with the instrument too. If they are not sufficient, please contact us and show the delivered invoice.

Accessories	Note
75Ω BNC-BNC testing cable	One
Charger	19V/3.42A
Manual Book / Disk	English

Table 1-1 Accessories

1.1.2. About the Charger

How to judge the status of the charger:

When charging if the spectrum analyzer is turned off, the red lamp will shine. Finished, the orange lamp will shine. When charging if the spectrum analyzer is turned on, the green lamp will shine. Finished, the orange lamp will shine.

Battery life span: 300 times recharged.

Cautions:

1. The charge time is about 5 hours, after the indicative lamp changed, please add one hour more. When finished, remember to turn off the power.

2. Battery short circuit is forbidden.

3. Disposing the battery in fire is forbidden, otherwise it will explode.

4. Do not try to open the battery and change its structure, nor distort the battery.

5. Do not throw the battery into water or other liquids.

6. Do not use or store the battery upon 60 degree Celsius.

7. Do not strike the battery and don't fall it down.

8. Do not charge the battery in reverse direction.

9. Charge voltage: 220V @ 50/60 Hz

1.2.About the User Manual

Please read the user manual carefully first before turning on the power of the instrument so that you can use it to its best performance level. There are some clues about the preparing process.

(1) Brief introduction about instrument's character

You can get a clear idea about the outlook of main part and accessories and distinguish different function combinations of them. Also you can know the main function and characters of the instrument.

(2) Main operating method of the instrument

The user manual gives detailed explanation about the daily use functions and using the measuring picture to tell the user the main operating methods.

(3) How to do Self- Calibration?

It is very important for the user / instrument to do calibration during its first use because it will affect the accuracy of the test. The user can calibrate the instrument according to the listed operating steps.

1.3.ESD (Electrostatic Discharge)

Electrostatic discharge can damage or destroy electronic components, so all work on electronic assemblies should be performed at an anti-static workstation. The following suggestions may help to reduce ESD damage that occurs during testing and servicing operations.

➢ Before connecting any coaxial cable to the instrument for the first time every day, momentarily ground the center and outer conductors of the cable.

➢ Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the unit.

➢ Be sure that all instruments are properly earth-grounded to prevent a build-up of static charge.

1.4.Technical Support and other Services

The instrument is warranted against defects in material and workmanship for a period of eighteen months. We provide the training to warrant that you can master the application of the instrument soon.

Deviser also provides technical support for your special use of the instrument including redesign (software for production, adjustments, alarms, and limit test) which is charged (only the cost for service), besides the above service we are ready to answer any questions from the user and provide you with technical support in updating the software. We welcome you to contact us on the following contact details：

Tel: +86-22-27682088

Fax: +86-22-27645002

Add: No 40, Yibin Road, Nankai District, Tianjin 300113, P.R. China

Domestic Customers: deviser@deviser.com.cn

Overseas Customers: overseasbiz@deviser.com.cn

Visit: www.devisertek.com

We will continuously improve our software to match the application developments and the users' requirements. We will constantly provide the application datum for the special uses of different application areas.

DS8821 serial spectrum analyzer has two models DS8821A (50Ωinput impedance) and DS8821Q (75Ωinput impedance). There are totally 7 options that can be chosen by user. (See Table 1-2)

Options	Function description
1.CATV measurement	Measure the indexes of analog cable TV
2. Narrow RBW	RBW to 30Hz ，VBW to 1Hz
3. Line Selection in CATV	Take the on-line measure of CATV by line selection
4. QAM analyzer	Measure the indexes of Digital TV
5. Tracking generator	0~-60dbm Tracking generator
6. Q_Lab	Management software of DS8821 serial spectrum analyzer
7. Video output converter	Convert the VGA signal to RCA and S_Video output

Table 1-2: Options

If you have the requirement of software or datum, Please connect us directly or connect the nearest agent of us.

2. Getting Started

Main points of this Chapter：

● **Front Panel of Instrument**

● **Rear Panel of Instrument**

● **Screen Annotation**

● **Menu Function and Menu Settings Annotation**

2-1

2.1.Front Panel

2.1.1. The Subassembly of Front Panel
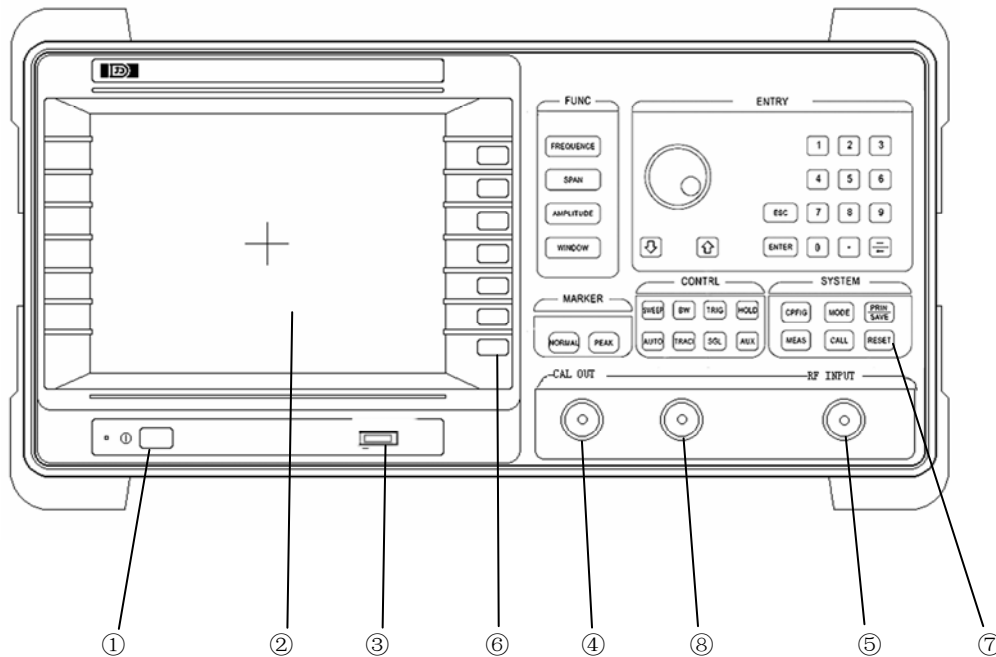
Figure 2.1 Front-panel

① **Soft-Power key**

As press the power key to turn-on/off the instrument, the green light (LED) beside the POWER key will shine to show that the instrument is working now.

Note:

After press this key, the software will receive a hardware interrupt. Then it will finish the current operation as fast as possible and save the useful characters. After that it will control the power to switch off. These operations protect the internal memory of the analyzer from being damaged by suddenly power supply off.

In some special conditions, such as update the software, this key will be out of work. At that time, the POWER key on the rear panel can take place of this key. (See 2.2 (9) Power switch)

② **TFT Colorful LCD**

Display the wave and parameters. The diagonal of it is 6.4 inches. It can display 640 pixels on X-axis and 480 pixels on Y-axis.

③ **USB Interface**

This port is prepared for the USB disk. USB keyboard can be connected to this port too.

④ **Calibration Signal Output Port（CAL OUT）**

Its' output is a standard radio frequency signal which frequency is 150MHz and amplitude is -20dBm. The type of connector is standard BNC type.

⑤ **Radio Frequency Input Port（RF Input）**

Input port of the RF signal. The frequency range of the signal is from 1MHz to 1GHz. The type of connector is standard BNC type and the driving point impedance of it is 75Ω/50Ω.

Caution:

If the input signal is overload, the attenuator and the input mixer of the instrument may be damaged. So you should be cautious when testing high-power RF sources and transmission systems. The Maximum input power is +20dBm.

Moreover if the voltage of the DC with the signal is too high, the input attenuator may be damaged too. So make sure that input DC voltage is lower than 100V.

⑥ **Soft-key**

Activate the corresponding function display on the screen.

⑦ **RESET**

Reset the instrument.

⑧ **Tracking Generator Output Port**

Tracking generator output the tracking signal from 1MHz~1000MHz with the amplitude range from 0~-60dbm.The type of connector is standard BNC type and the output impedance is 75Ω/50Ω.

2.1.2. The Front Panel Keys
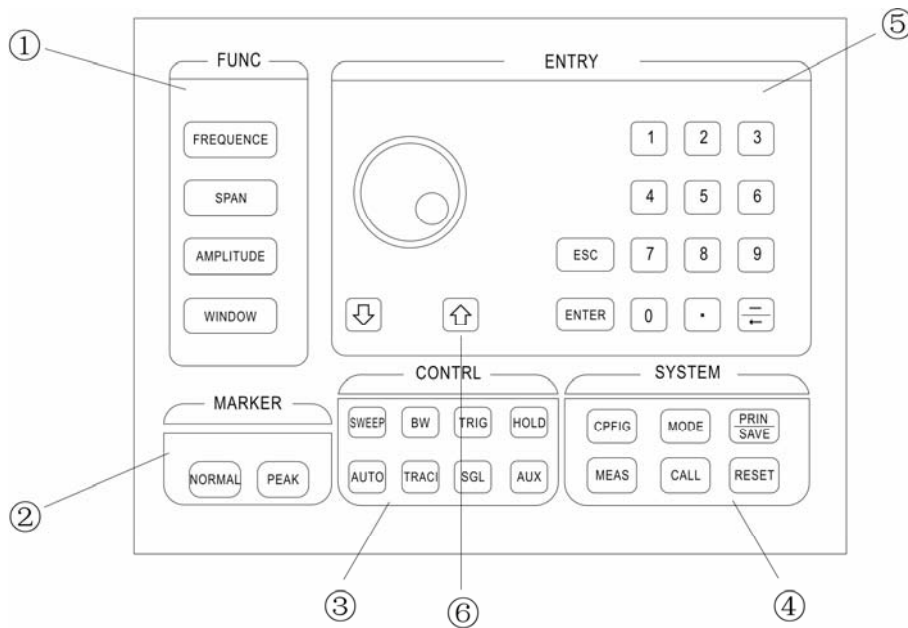
Figure 2.2 Front-Panel Key

(1) FUNC

◆ **FREQENCY**   Frequency setting key

Set the "Center Frequency", "Start Frequency", "Stop Frequency" and "Frequency Step" in the corresponding menu of this key.

◆ **SPAN**   Span setting key.

Set the value of sweep span.

◆ **AMPLITUDE**   Amplitude parameter setting key

Set the reference level, attenuator, "Log/Line" state, amplitude unit and the display scale etc.

◆ **WINDOW**   Double windows key

After press this key, you can choose "On/Off" state of double window display mode, switch between two windows, set zone center and zone position of the up-window etc by pressing the corresponding soft-key in the submenu of it.

(2) MARKER

◆ **NORMAL**   Markers setting key

In the menu of this key, you can set the "On/Off" state, get the information or do the comparison of every marker. In spectrum mode, you can set 8 markers at most.

◆ **PEAK**   Peaks setting key

After pressing this key, the system will set a marker on the peak value of the wave and display the frequency and amplitude information of this marker at the same time. Also you can open the peak table, set the peak track etc in the corresponding menu of this key.

(3) CONTROL

◆ **SWEEP**   Sweep parameters setting key

Set sweep time and sweep mode in the corresponding menu of this key.

◆ **BW**   Bandwidth setting key

Set the value of resolution BW and video BW. Choose the "On/Off" state of video average and input the needed average time when the video average is "On".

◆ **TRIG**   Trigger mode setting key

Set the trigger to "Free Run", '"Video" or "TV-H" and set the corresponding characters of these triggers.

◆ **HOLD**   Hold key

Hole current wave and settings on the screen until press this key again.

◆ **AUTO**   Auto key

Set the "Auto/Manu" state of RBW, VBW, Sweep etc.

◆ **TRACE**   Trace and detector select key

Select the active trace A, B or C and set the state of these traces. Select the detector mode among the 6 modes the system provided.

◆ **SGL**   Single sweep key

Press this key to activate a single sweep.

◆ **AUX**   AUX control key

You can enter the power measure, get the demodulation result of AM/FM and set the limit line in the menu of this key.

(4) SYSTEM

◆ **CONFIG**   Config key

User can configure the system by pressing the corresponding soft-key in the menu of this key. Also you can get the serial number and software/Firmware version by this key.

◆ **MODE**   Mode select key

Select the mode from the instrument supported modes such as "Spectrum Analyzer", "CATV Analyzer", "QAM Analyzer" or "Tracking Generator"(some modes are options).

◆ **PRINT/SAVE**   Screen print /save key

According to the selection state of "Prn/Save", output/save current information that display on the screen to the printer/memory.

◆ **MEAS**   Measure key

You can get the measure result of NdB BW or display delta, temperature and current voltage in the menu of this key.

◆ **CAL**   Calibration setting key

You can calibrate the frequency, amplitude or both of them in the menu of this key. Also you set the "On/Off" of calibrate data and response data.

◆ **RESET**   Reset Key

(5) DATA

◆ **0** ～ **9**   Number key

◆ **•**   Dot key

◆ ⇄   Negative/ Backspace key

◆ **ENTER**   Enter key

Press to confirm the input.

◆ **ESC**   ESC key

Press to escape the current state

(6) SELECT

◆ ⇓   Down key

◆ ⇑   Up key

◆   KNOB

2.2.Rear Panel
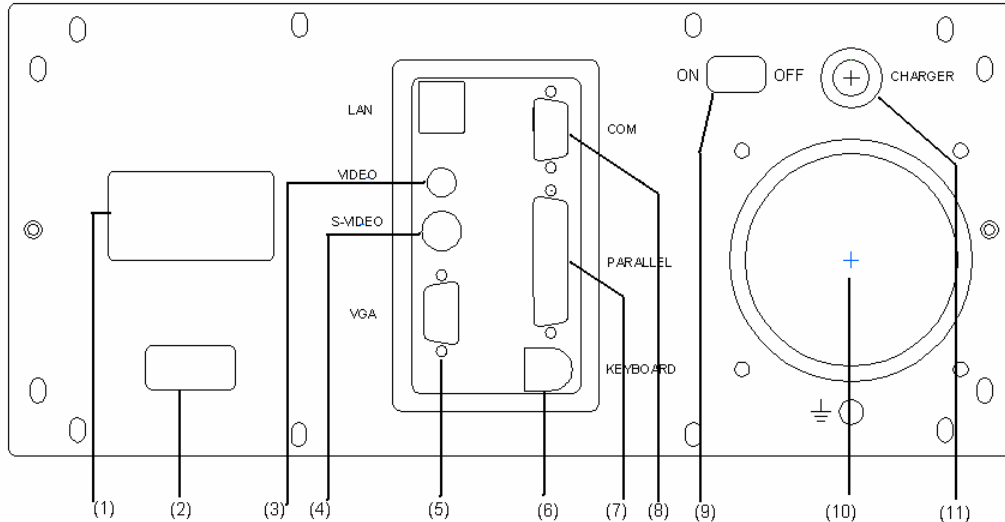
Figure 2.3 Rear panel

(1) Nameplate

Company information

(2) Tag

Instrument information

(3) Video Output (Option 7)

Composite Video output Port of the display screen

(4) S-Video Output (Option 7)

S-Video output Port of the display screen

(5) VGA Output

Standard VGA output port

(6) Keyboard

Standard PC keyboard output port

Caution:

Please shut down the power before connect a keyboard with the analyzer, or it may be damaged.

(7) Parallel Port

Standard port for printer

Caution:

Please shut down the power before connect a printer with the analyzer, or it may be damaged.

(8) RS-232

RS-232 port for communication

Caution:

Please shut down the power before connect a PC with the analyzer, or it may be damaged.

(9) Power switch

Directly power on or off the analyzer.

Caution:

This key control the power supply directly. The internal memory of the analyzer may be damaged, if it is pressed when the system is operating the memory. So it is recommended to press the soft-power key on the front panel to power on or off the analyzer unless the soft-power key can't work in some special conditions.

(10) Fan

To protect instrument, if the temperature is too high, fan will automatically start.

(11) Charge port

Charger input port.

Warning:

Make sure to use the charger provided for this instrument. Otherwise the operator and the instrument may be damaged.

2.3.Screen Information

2.3.1. Spectrum Analyzer Screen

(1) Single Window

The Spectrum that display in single window mode is shown as figure 2.4.
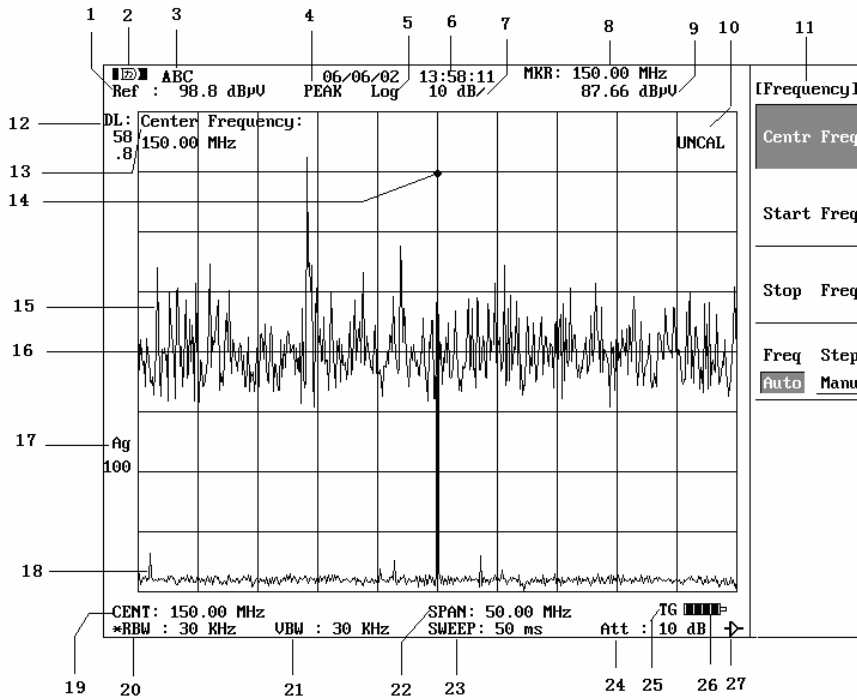
Figure 2.4 Single Window Mode

The information we can get from the screen of single window mode is listed in table 2-1.

Table 2-1 Spectrum Screen information

Item	Annotation	Description
1	Reference Level	Current reference level
2	Logo	The logo of Deviser
3	Title	Displays the title you have entered to distinguish the current data from other data
4	Detector	The search mode which is currently selected.
5	Log/Line	Current amplitude display mode logarithmic or linear
6	Date & Time	Current date and time
7	Scale	Current amplitude scale graduation
8	Marker Frequency	The frequency of the selected marker
9	Marker Amplitude	The amplitude of the selected marker
10	"UNCAL" message	Indicates that the measurement is in an illogical settings
11	Soft-menu	Menu item corresponding to the soft key
12	Position of display line	Shows values for the display line
13	Active area	Used to display the currently active functions (note that the data can be changed) and their related values
14	Marker	
15	Display line delta	Shows change of the current wave to the wave when "'DL Delta' turn on
16	Display line	The zero position of the Delta wave
17	Average Count	Displays the averaging times
18	Waves	
19	Center Frequency	Indicates the frequency at the center of the current display
20	RBW	Displays the current resolution bandwidth (RBW is preceded by an asterisk (*) when set in manual mode)
21	VBW	Frequency selected for the video bandwidth filter. VBW value is preceded by an asterisk (*) when set in manual mode.
22	Span	Frequency span of the current display
23	Sweep Time	Time required to make a single sweep. SWP is preceded by an asterisk (*) when set in manual mode
24	RF Attenuator	Current attenuator level. ATT is preceded by an asterisk (*) when set in the manual mode
25	Tracking generator	Indicate the status of tracking generator. (TG display on the screen means TG is on)
26	Battery status	The voltage status of the battery
27	Preamplifier status	It display on the screen means preamplifier is open now

(2) Double Windows

Press **WINDOW** to enter double windows mode, then the screen will display as Figure 2.5 shows. Except the same screen information as the single window, there is an "A" flag on the right-up corner of the up/down screen. It indicates the current active window.
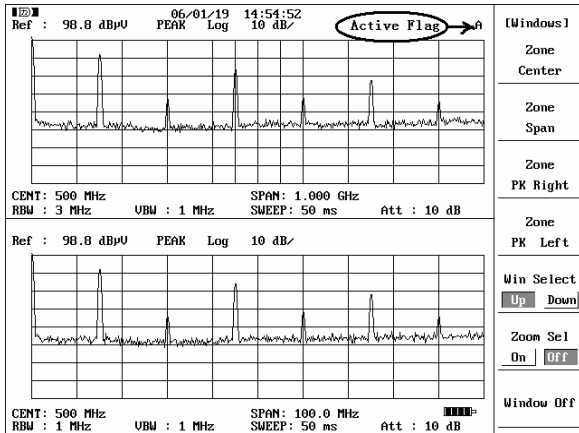
Figure 2.5 Double window

(3) Information Window

The information window only appears in some special conditions, such as in CATV measure, FM demodulation or channel power measure. Figure 2.6 shows the display of information window.
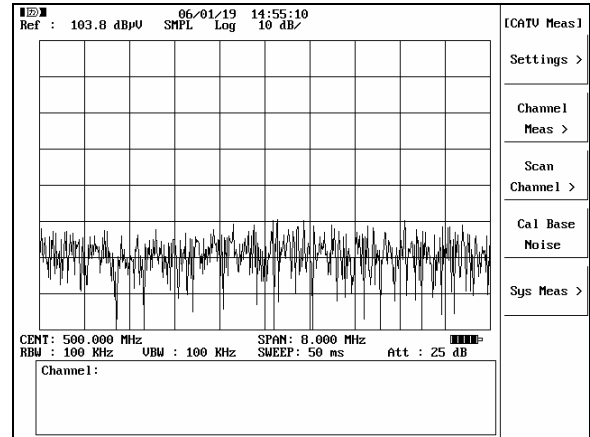
Figure 2.6 Information Window

2.3.2. QAM Analyzer Window

The QAM analyzer window is shown as Figure 2.7.
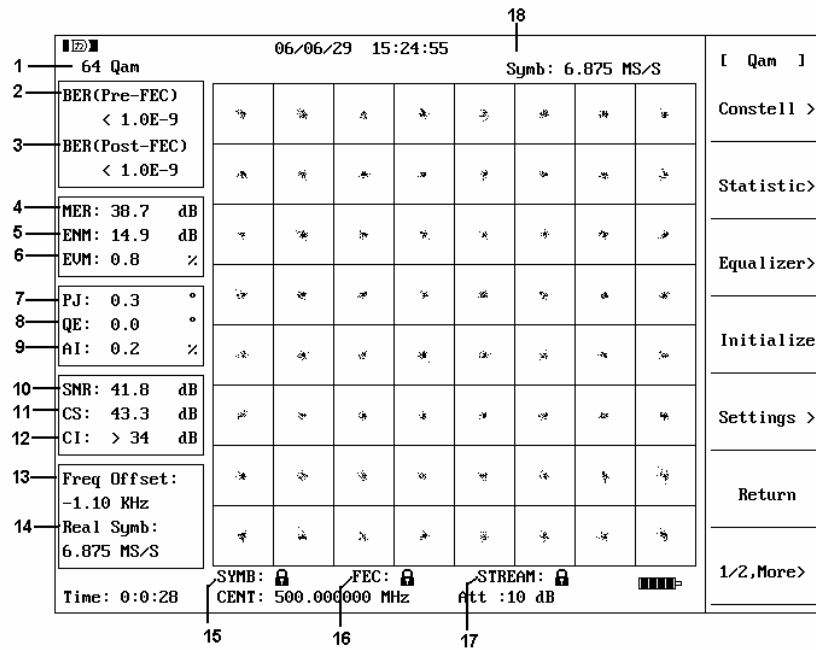
Figure 2.7 QAM Analyzer Screen

The information we can get from the screen is listed in table 2-2.

Table 2-2 Spectrum Screen information

Item	Annotation	Description
1	Modulation mode	Current modulation mode
2	BER before RS decoder	The ratio of the erroneous bits that before RS decoder and the total number of transmitted bits.
3	BER after RS decoder	The ratio of the erroneous bits that after RS decoder and the total number of transmitted bits.
4	Modulation Error Ratio	Provide a single "figure of merit" analysis of the received signal.
5	Estimated Noise Margin	Provide an indication of the reliability of the transmission channel without switching off the service.
6	Error Vector Magnitude	Another "figure of merit" calculation
7	Phase Jitter	Indicate the fluctuations of signal phase or frequency
8	Quadrature Error	The quadrature error of the two carriers feeding the I and Q modulators
9	Amplitude Imbalance	Separate the QAM distortions resulting from AI of the I and Q signal from all other kinds of distortions.
10	Signal-to-Noise Ratio	Denotes the ratio of the QAM signal power to the noise power.
11	Carrier Suppression	Denotes the ratio of the QAM signal to an unwanted coherent CW signal.
12	Coherent interferer	Denotes the ratio of the QAM signal to the interference signal
13	Frequency Offset	The frequency offset relative to the current frequency setting
14	Real Symbol Rate	The current real symbol rate (calculated by system)
15	Symbol Lock	The symbol lock flag
16	FEC Lock	The Forward Error Correction lock flag
17	Stream Lock	The code stream lock flag
18	Symbol Rate	The current symbol rate (User or system set)

2.4.Menu Tree

This part lists the menu tree that ordered by characters. Some menus only can be activated in the instrument with corresponding options.

AMPLITUDE   Amplitude Settings

Ref Level

Atten   Auto/Manu

Scal Log/Line

Amp Units>

Scale/Div

Ref Offset   On/Off

Amplitude   On/Off

- dBm
- dBmV
- dBμV
- mV
- Return

AUTO   Auto Settings

Auto All

Res BW   Auto/Manu

Video BW   Auto/Manu

Atten   Auto/Manu

Sweep Time   Auto/Manu

CF Step   Auto/Manu

AUX   Auxiliary Settings

Power Mea>

Demod>

Impedance

Limit Line>

Channel Power>

Occupied BW>

Adj Chan Power>

Settings>

Average   On/Off

QAM

Stop Meas

Single

Continuous

Stop Meas

Channel Spacing

Channel Band Width

Occupied BW %Power

Return

Demod   AM/FM

Listen On   On/Off

FM Gain

Return

Limit Test   On/Off

Limit Line   On/Off

Beep   On/Off

Settings>

Stop Meas

Save

Return

BW   Band Width Settings

Res BW   Auto/Manu
Video BW   Auto/Manu
Video Avg   On/Off

CAL   Calibration Settings

Calibrate Freq&Amp
Calibrate Frequency
Calibrate Amplitude
Cal Data   On/Off
Resp Data   On/Off

CONFIG   Configuration Settings

SN
Select   Prn/Sav
RS-232 Baud Rate>
Set Clock   On/Off
Language Select>
Print/Save>
1/2,More>

9600
19200
38400
57600
115200

Return

English
Chinese

Return

Epson-ESC/P
HP-PCL>
Return

1 Pic/Page
2 Pic/Page
Return

Transmit File>
Delete File
View

RS-232
USB Disk
Return

Print>
Save>

Preview>

Return

Page Up
Page Down
Return

Service>
Palette>
About>
Status>
Date Format>

2/2, More>

RS Update
USB

Return

Yes
No

Return

Info
Wave
Edit Back
Back
Auto set>
Save

Return

Indoor
Outdoor

Return

YY-MM-DD
MM-DD-YY
DD-MM-YY

Return

Save
Load
Delete
View
Return

Return

FREQUENCY Frequency Settings

    Centr Freq

    Start Freq

    Stop Freq

    Freq Step   Auto/Manu

HOLD   Hold current screen (no menu)

MEAS   Measure Settings

NdB PTS   On/Off

Disp Line   On/Off

DL Delta   On/Off

Temper   Select

Voltage   OK

Title>   Return

NORMAL   Marker Settings

Mkr Normal   Count   On/Off

Delta Mark   Select Mkr   1 2 3 4 5 6 7 8

Fixed Mark   Marker 1   On/Off

Marker to Center   Mark Table   On/Off

Marker to Ref Lvl   Mark Noise   On/Off

All Off   Noise/Hz   On/Off

1/2, More>   2/2,More>

MODE   Mode Select

Spectrum Analyzer>   Settings>   Channel Table>

CATV Analyzer>   Channel Meas>(1)   Select   Chan/Freq   OK

QAM Analyzer>   Scan Channel>(2)   Frequency Setup>   Return

Tracking Generator>   Cal Base Noise   Amp Unit≥

                    Sys Meas>   (3)   Amplifier>

    TG   On/Off   Return

    TG Level   Constell>   (4)   dBm

    Power Cal   Statistic>   (5)   dBmV

    Normalize   Equalizer>   (6)   dBµV

    Mark   Abs/Ret   Initialize   Return

    Return   Settings>   (7)

                    Return   Auto

                    1/2, More>   On

                                    Off

                  Power Mea>   Return

                  Return

                  2/2,More>

(1) → Channel Select → Listen OFF
Listen ON>

FM DEV> → Return
Depth MOD Add Att
Carrier Lvl/Freq Sub Att
Prev Menu Cycle/Meas
1/3, More>

Normal> → Line
TV-Line> Field   Odd/Even
Return Return

Return
Add Att
Sub Att
Counter   On/Off
Max Hold On/Off

Carrier Noise> Return Line
HUM> Add Att Field   Odd/Even
Crossmod Sub Att Average On/Off
CSO/CTB> Measure Noise BW Auto/Manu
Leakage> Continue View Meas/Vid
Prev Menu Gate   On/Off
2/3 More> 1/2, More> 2/2, More>

Return
Add Att
Sub Att
Measure Time/FFT

Return
Add Att
Sub Att
Average   On/Off

Return Line
Add Att Field Odd/Even
Sub Att Average On/Off
Measure Next Chan
Continue Last Chan
Next Beat Gate On/Off View Meas/Vid
1/3, More> 2/3,More> 3/3, More>

CLDI> (1-1) Return
DIF Gain & DIF Phase> (1-2) Add Att
In –Channel Response>(1-3) Sub Att
Prev Menu
3/3, More>

(1-1) → Line
Field   Odd/Even
Signal> →
Add Att
Sub Att
Average   On/Off
Return

CCIR LN17 // FCC CTS(Note)
UK ITS   // NTC-7 CTS(Note)
GB LN19   //

Return

(1-2) → Line
Field   Odd/Even
Signal> →
Add Att
Sub Att
Average   On/Off
Return

CCIR LN330 // FCC CTS (Note)
UK ITS   //   NTC CTS (Note)
GB LN19   //

Return

(1-3) → Sweep Sig →
VITS Test
Return

Marker 1
Marker 2
Max Hold   On/Off
RBW   300K/100K
Signal> →
Return

GCR
Multiburst
Return

Marker 1
Marker 2
RBW   300K/100K
Line
Field   Odd/Even
Return
1/2, More> →

View   Meas/Vid
Signal>
Return
2/2,More>

NOTE: Right-side in PAL standard, while left-side in NTSC standard.

(2) → Standard Channel> →
User Channel>
Favorite Channel> →
Lvl Limit
Return

Measure
Ref Line   On/Off
Count   On/Off
Return

Analog
Digital
Count   On/Off
Return

Measure
Fav Set 1
Fav Enter
Return

2-15

(3) → Measure | View> → Page Up
View> → | Page Down
Return | Delete | Return
| Upload> →
| Return | RS-232
| | USB Disk
| | Return

(4) → Refresh
Grid　On/Off
Template On/Off
Zoom In | Continuous
Zoom Out | Cyclic
Display Mode> → Time Filter
Return | Return

(5) → Set Time
Measure　Star/Stop
View Last>
Return

(6) → Set Equ> → Off
All | Freeze
Equalizer | UnFreeze
Frequency Response | Special
Group Delay | Distance　m/foot
Return | Return

(7) → Centr Freq | Auto
Symb Rate　Auto/Manu | On
Atten　　　Auto/Manu | Off
Amplifier> → Return
Modulation Mode>
Return | 16QAM
1/2, More> | 32QAM
| 64QAM
| 128QAM
MER Th　　　Auto/Manu | 256QAM
BER-PRE Th　Auto/Manu | QPSK
BERPOST Th　Auto/Manu | Return
Standard> → J83ANNEX A
Polarity> | J83ANNEX B
Default | J83ANNEX C
2/2, More> | Reverse
| No FEC Decoding
| Return
Auto
Normal
Reverse
Return

PEAK   Peak Search

Next Peak

Next Peak Right

Next Peak Left → PK Table On/Off

Marker to Center   PK Sort   Freq/Amp

Marker to Ref Lvl   PK Track On/Off

1/2,More> → 2/2, More>

PRINT/SAVE   Print / Save Screen

SGL   Single Sweep (no menu)

SPAN   Span Settings

Span

Span Zoom

Full Span

Zero Span

Last Span

SWEEP   Sweep Settings

Sweep Time   Auto/Manu

Sweep   Cont/Sigl

TRACE   Trace & Detector Settings

Trace A B C   Sample

Write A (B C)   Posi-Peak

View A (B C) → Neg-Peak

Blank A (B C)   Normal

Max Hold A (B C)   Average

Detector> ——   Return

TRIG   Trigger Settings

Sweep   Cont/Sigl → Line

Free Run   Field   Odd/Even → B/D/G/I/H/K/K1/L

Video   Standard> ——   M/N

TV-H> ——   Return

Slope   +/-

WINDOW   Double Windows

Zone Center

Zone Span

Zone PK Right

Zone PK Left

Win Select   Up/Down

Zoom Sel   On/.Off

Window Off

3. Basic Measurement

Main points of this chapter：

● **Basic Function**

● **Basic parameters settings**

● **Essential measurement and operation methods**

3.1.Basic Function

The basic function of spectrum is to get the frequency and amplitude characters of the input signal. So the basic keys are **FREQUENCY** , **SPAN** and **AMPLITUDE** . These keys locate on the up-left of the keyboard that is shown as follows.
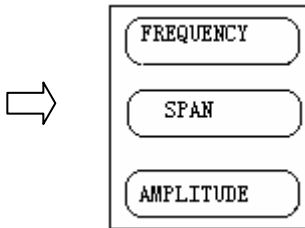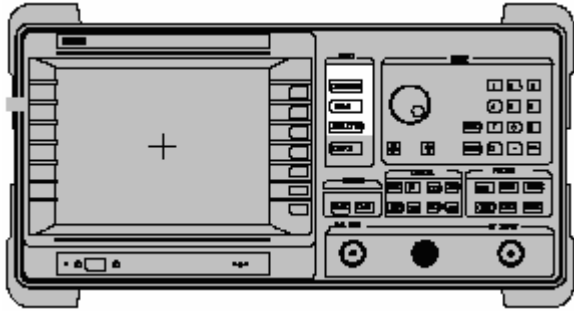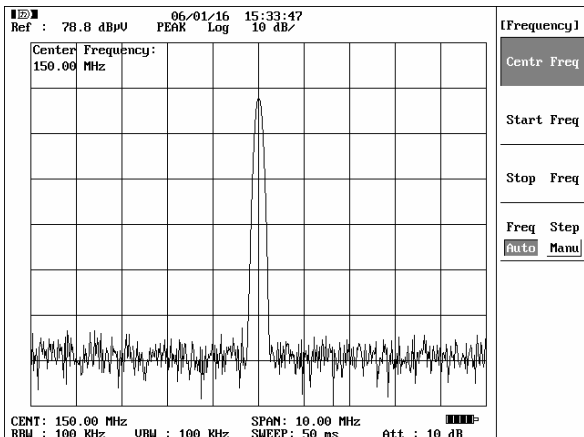

3.1.1. Frequency
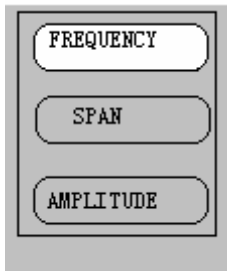
Press **FREQUENCY** key, the submenu of it will appear:

Figure 3.1 Frequency Menu

（1）**Center Frequency**

Press "Centr Freq" soft-key, user can change the current center frequency. There are three methods to input the frequency value:

1. Directly input the number: Press the number keys, the "Unit" menu will appear, which is shown as Figure 3.2. Select the unit in this menu then user can finish the center

frequency change.
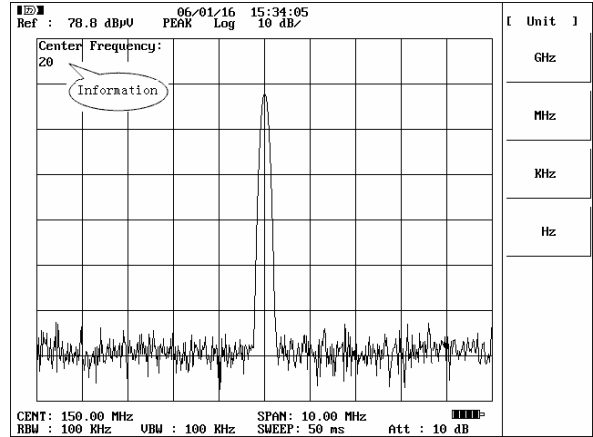
Figure 3.2 Frequency Unit Menu

For example: If user want to set the center frequency to 20MHz, press the number key "2" and "0" then choose the "MHz". The change of center frequency is finished.

Note：

1. The frequency range is from 0 to 1000MHz, if the input is little/ more than 0Hz / 1000MHz it will be treated as 0Hz / 1000MHz.

2. In most parameter input cases, the information about the item and the input value will display on the screen. (See Figure 3.2)

---

2. Press the "Up/Down" key: change by the step that is defined by "Freq Step".

3. Rotate the knob: change by a step of 1/500 of the span.

User can take the same way to input the value of "Start Freq", "Stop Freq" and "Freq Step". But if the input value is "Freq Step", the change step of "Up/Down" key will become to 1/500 of the span.

(2) Start Frequency

After pressing "Start Freq" soft-key, user can change the start frequency.
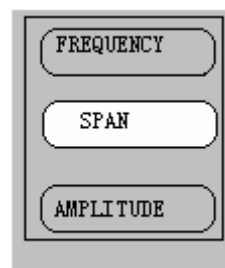
(3) Stop Frequency

After pressing "Stop Freq" soft-key, user can change the stop frequency.

(4) Frequency Step

The default value of "Freq Step" is 1/10 of the span. After pressing the "Freq Step" soft-key and set it to "Manu", user can input the frequency step.

3.1.2. Sweep Span

Press the **SPAN** key, then the submenu will appear, which is shown as Figure 3.3.
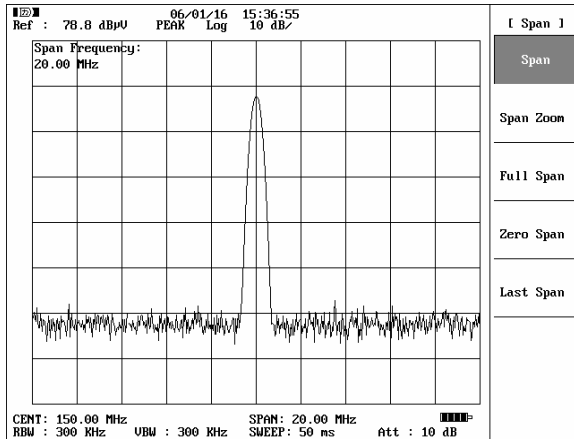

Figure 3.3 Span Menu

(1) Span

Span equals the stop frequency minus the start frequency. The span setting determines the horizontal-axis scale of the analyzer display. The span range of the instrument is from 0Hz to 1000MHz. The larger span is set, the more signal can be viewed, the lower precision the measurement will get. On the contrary, the narrower span is set, the fewer signals can be viewed, the higher precision the measurement will get. So choosing the appropriate span is important.

There are three methods to change the span: first is manually input; second is to press the Up/Down key which change step is 1,2,5, and the change sequence is 200Hz, 500Hz, 1KHz, 2KHz…. 1000MHz; last is to rotate the knob, the change step is 1/100 of the span.

Note：

1. When the RBW is set to "Manu", too large span will cause the imprecision of the measurement. In such cases the system will give the prompt "UNCAL". See also 3.2.1 ---Band Width.

2. Press "Up/Down" key cannot change the span to 0Hz.

3. When press "Up/Down" key to change span, if the current span isn't one of the change sequence, it will be treated as the nearest lower one in the sequence. For example, 199Hz will be treated as 0Hz, if press "Up" key now, the span will become to 200Hz.
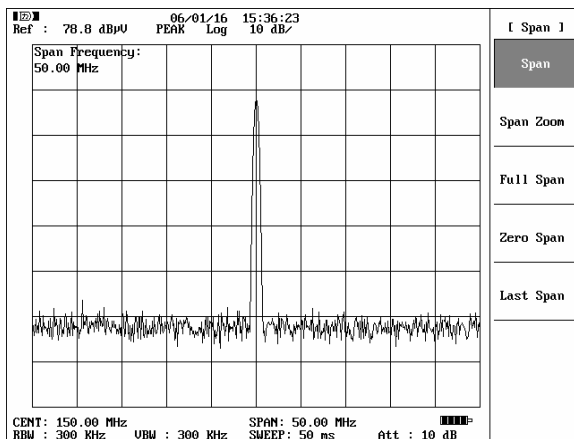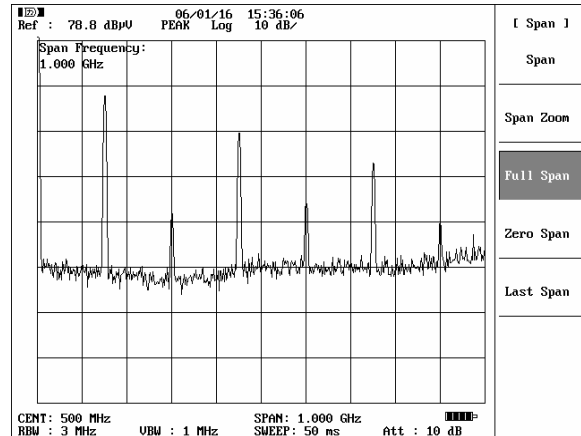

Figure 3.4 Narrow BW

Figure 3.5 Wide BW

(2) Span Zoom

Press this soft-key, the system will search the peak signal from all signals and set the frequency of this signal to the center frequency and then choose an appropriate span for the display of this signal.

(3) Full Span

Change the span to 1000MHz.

(4) Zero Span

Change the span to 0Hz. This is up to see the time domain information of selected frequency. Zero span is very useful to observe the characters of AM and FM signal and the signal of time domain. (See also 4.2)

(5) Last Span

Change the current span back to last span. User can directly change between current span and last span by pressing this soft-key in order to view the difference of the signal display between these two conditions.

3.1.3. Amplitude
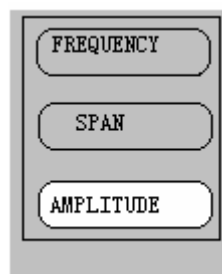
Pressing **AMPLITUDE** key, the submenu will appear, which is shown as Figure 3.3.
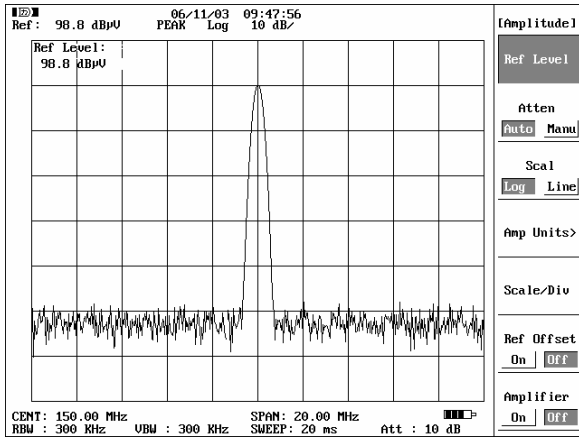
Figure 3.6 Amplitude Menu

(1) Reference Level

Reference level is display on the up-left of the screen, which is sign as "Ref" (See figure 3.7). The default value of "Ref" is 98.8dBµV.
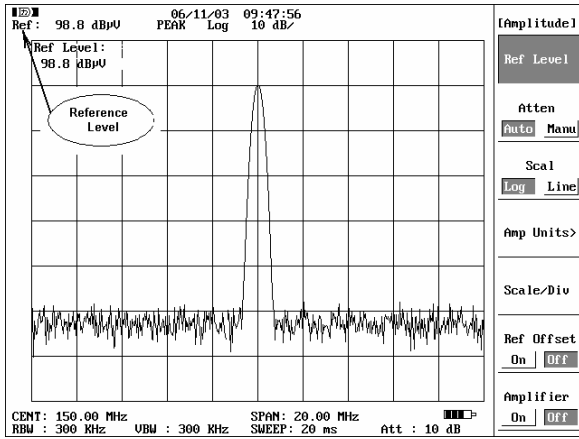

Figure 3.7 Reference Level

Note：

The smallest value of reference value is changed according to the different attenuator setting. The details will be introduced in next section.

User can set the unit of reference to dBm, dBmV, dBµV, mV, V, µV or nV in the instrument. The exchange formula between different units is shown as table 3-1.

Formula	Source value	New value
dBm = dBµV - 108.8	68.8 dBµV	-40 dBm
dBm = dBmV - 48.8	8.8 dBmV	-40 dBm
dBm = 20*log(MV) – 48.8	2.778 MV	-40 dBm

Table 3-1 Exchange formula from other units to dBm

Table 3-1 only lists the formula to dBm, if user like user can deduce the others.

Three methods to change reference level：

1. Input by number key: After inputting the number, the unit menu will appear. Choose the unit user need to finish the reference level input.

2. Input by "Up/Down" cursor: The change step of this method is the amplitude that one grid corresponds to.

3. Input by Knob. The change step of this method is the amplitude that 1/10 grid correspond to.
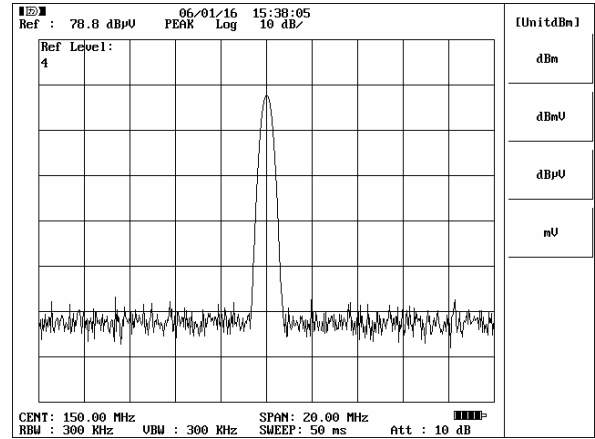

Figure 3.8 Reference Level Input

(2) Attenuator

Attenuator is an important part of the Instrument. It can reduce the signal distortion by attenuating the power level of the mixer input signal. The value of attenuator is from 0 to 55dB with 5dB step, the default value is 10dB.

Increasing the value of attenuator can diminish the mixer distortion, but the base noise of the system will increase too that will reduce the range of measurable signal. In auto mode, the system can automatically provide a suitable value of attenuator. If user wants to set the attenuator manually, user should firstly set the "Atten" softkey in figure 3.7 to "Manu" and then input the value by number keys, "Up/Down" key or the knob. By "Up/Down" cursor or the knob, the change step is 5dB and can't set attenuator to 0dB.


Caution：

The amplitude of signal input to mixer should little than -20dBm, otherwise the signal may be distorted.

---

(3) Scale Log/Line

In "Log" state, the difference of Y-coordinate has the direct ratio to ΔdB, while in line state it has the direct ratio to voltage difference ΔV. In most cases, the instrument is in logarithm state, but in some special cases (for example when measure the modulation degree of AM), the line state is the better choice.

The common used unit in logarithm state is dBm, dBµV or dBmV. The wave will not change with the change of unit.

The common used unit in line state is mV, V, µV or nV. The wave will not change with the change of unit too.
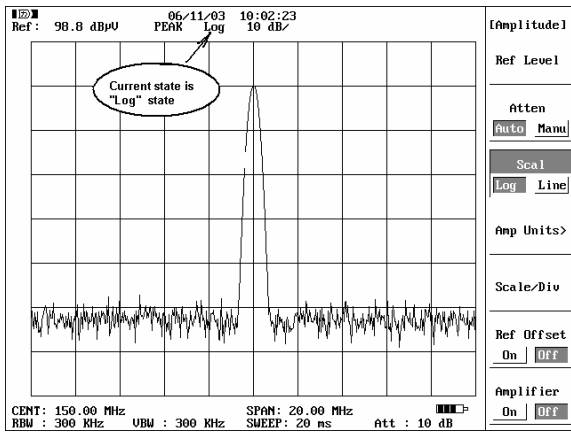
(a) Log State: Ref is 98.8 dBµV
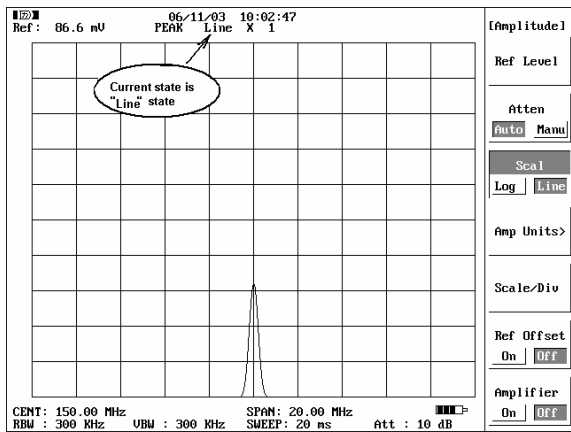
(b) Line State: Ref is 86.6 mV

Figure 3.9 Contrast of "Log" and "Line" State

Figure 3.9 shows the difference measure results of the same signal one in "Log" state and the other in "Line" state.

(4) Unit

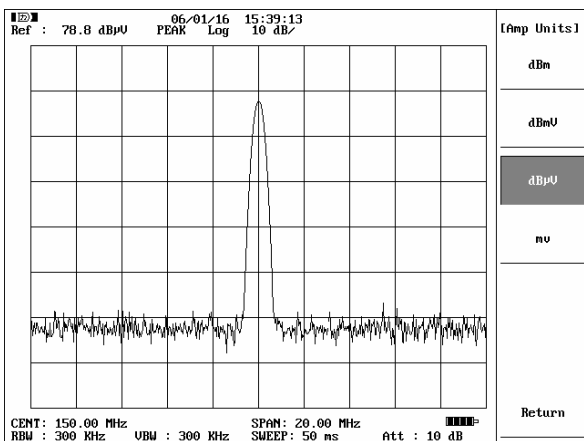Press the "Amp Units" soft-key, the submenu of it will appear:

Figure 3.10 Amplitude Unit Menu

Choose the unit user wanted and then press the "Return" soft-key to finish the setting.

Note：

The change of unit will not cause the change of "Log/Line" state.

(5) Scale/Div

The scale/div is displayed on the upside of the screen.

◆ **In logarithm state:** the default value is 10dB/grid. After pressing "Scale/Div" soft-key user can enter the integer number from 1 to 40 or decimal number from 0.1 to 0.9 to change the scale to the state wanted. The scale/div can be changed by "Up/Down" cursor or by knob too.

◆ **In line State:** The "scale/div" state is shown as × n. After pressing "Scale/Div" soft-key, the submenu of it will appear. User can choose ×1, ×2, ×5 or ×10 in this submenu. 1/n is the ratio of voltage difference between the lowest level displayed on the screen and reference level. For example when reference level is 1mV, if the Scale/Div is ×1, the lowest voltage display on the screen is 0mV, while if the Scale/Div is ×2, the lowest voltage display on the screen will be 0.5mV.
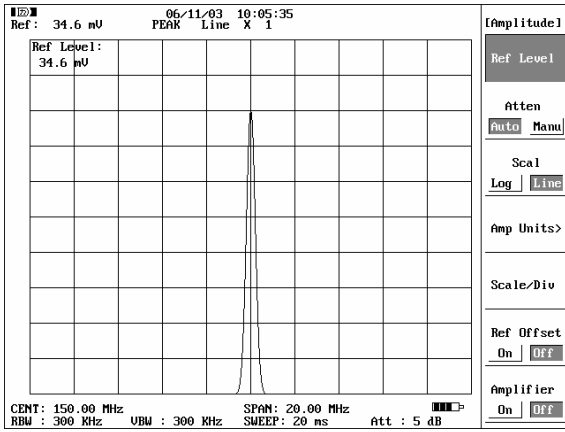
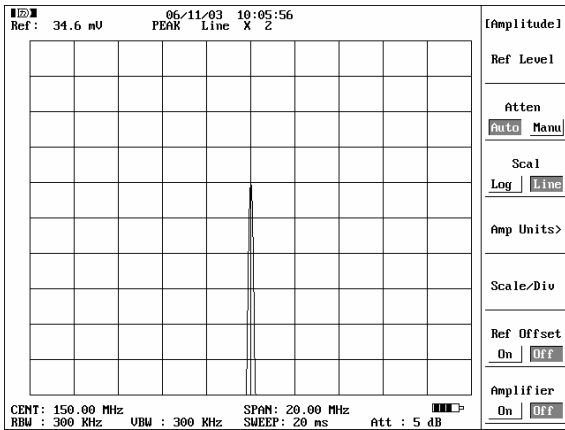No matter in "Log" or "Line" state, the change of "Scale/Div" will not change the measure value.

(a) 10dB/Grid in "Log" State
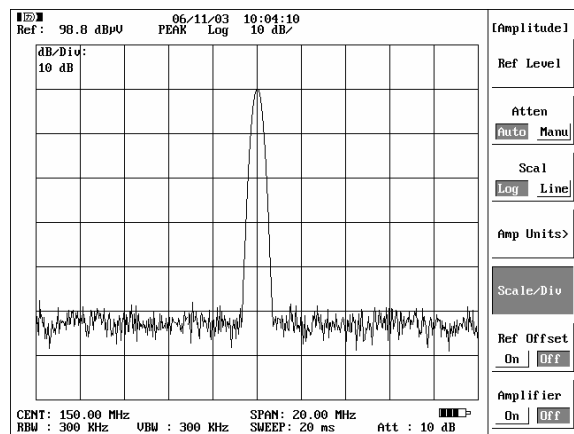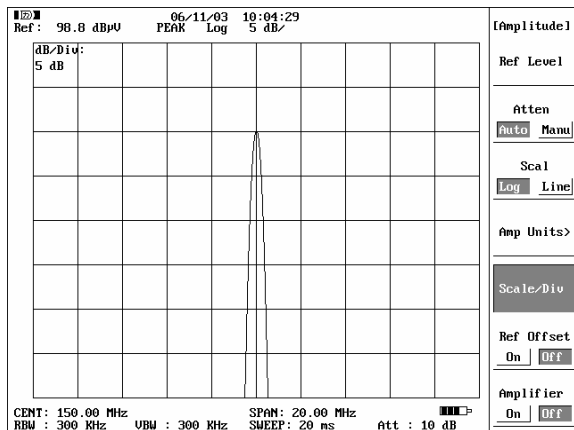
(b) 5dB/Grid in "Log" State

(c) ×1 in "Line" State

(d) ×2 in "Line" State

Figure 3.11 "Scale/Div"

(6) Ref Offset:

"Ref Offset" indicate the reference offset level. For example, if the "Ref Offset" is set to "On" state and its' level is set to 25dB, then the reference level and the marker level that display on the screen will be changed as Figure 3.12 and 3.13 show.
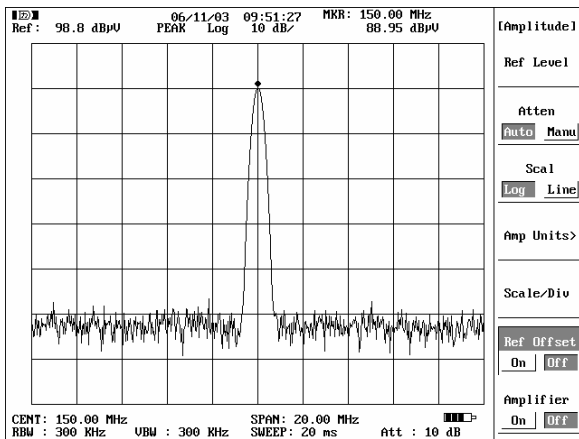

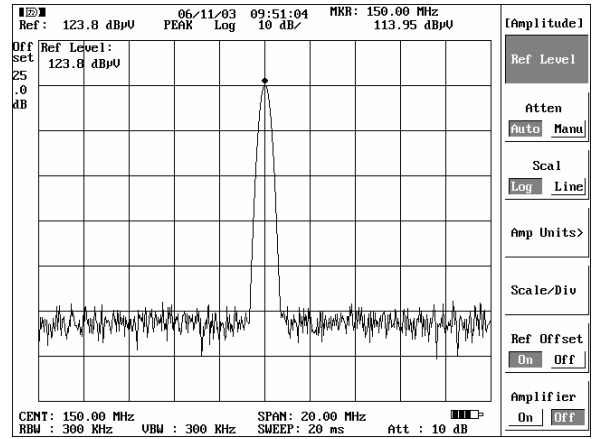Figure 3.12 Reference Level Offset Off

Figure 3.13 Reference Level Offset On

(7) Preamplifier:

There is a preamplifier in DS8821. By pressing "Int Amp" soft-key, user can set the "On/Off" state of this amplifier according to the signal intensity.

3.2.Basic Parameters Settings

Basic parameters of spectrum refer to RBW, VBW, sweep mode, sweep time, trig mode etc. The keys about these settings are located on the bottom of front panel, which is shown as the follow picture.
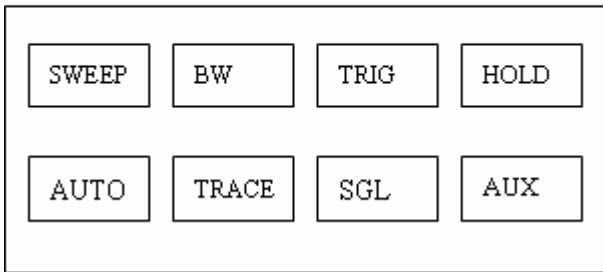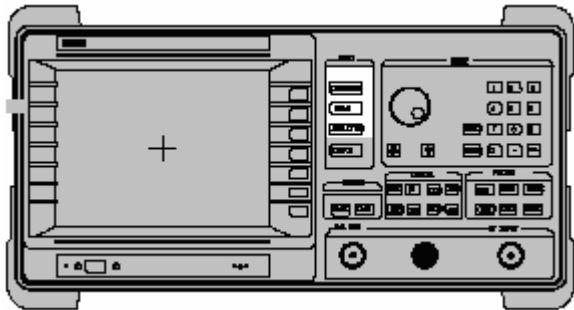
3.2.1. Band Width
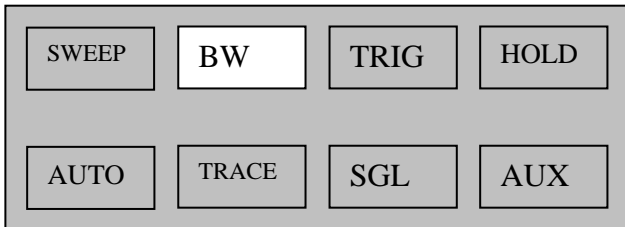
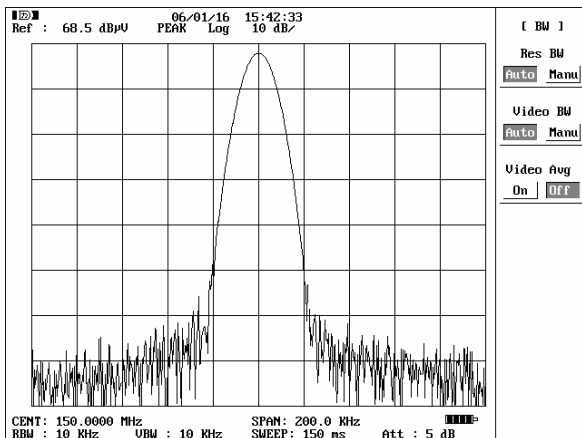Press **BW** key，the submenu of it will appear which is shown as Figure 3.12.

Figure 3.14 BW Menu

（1）**Resolution BW**

Resolution bandwidth (RBW) refers to the IF filter bandwidth of spectrum analyzer. RBW define the smallest frequency difference of two adjacent signals that can be distinguished by the spectrum analyzer. So the narrower the RBW is set, the higher precision the spectrum has. But it need more establish time with narrow RBW (see also 3.2.2). If the sweep time can't fulfill the requirement of RBW, the system will give the prompt "UNCAL".
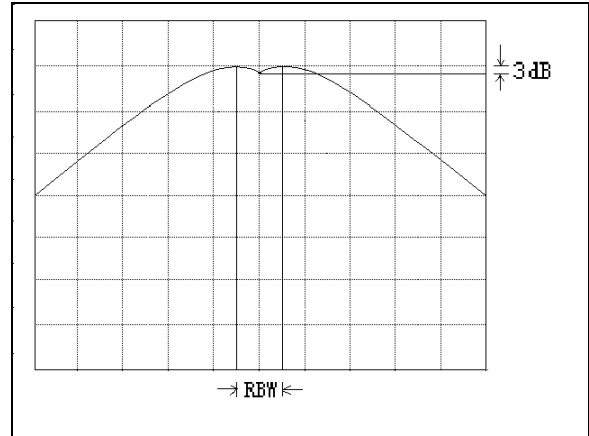

Figure 3.15 The Largest RBW That can Distinguish the Signals

If RBW is set to "Manus" state, when span frequency exceeds the range, which is listed in Table 3-2, the system will give the prompt "UNCAL".

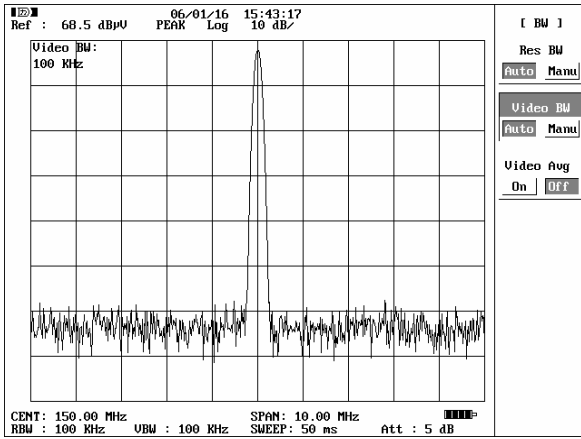| Span	RBW
Span <= 5 KHz	30 Hz *
Span <= 10 KHz	100 Hz *
Span <= 20 KHz	300 Hz *
Span <= 50 KHz	1 KHz
Span <= 100 KHz	3 KHz
Span <= 1 MHz	10 KHz
Span <= 5 MHz	30 KHz
Span <= 10 MHz	100 KHz
Span <= 50 MHz	300 KHz
Span <= 500 MHz	1 MHz
Span > 500 MHz	3 MHz

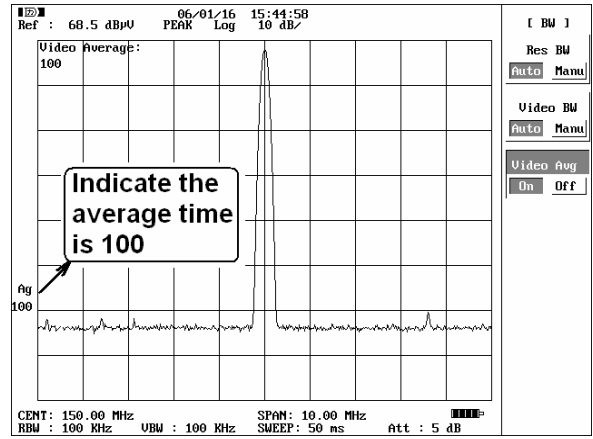Table 3-2： RBW "Auto" settings

*: Need the option 2.

The RBW can be changed from 30Hz to 3MHz, taking the step of 1,3,10. After setting the "Res BW" to "Manu" state, user can change the RBW by inputting the number, pressing the "Up/Down" cursor or rotating the knob.

（2）**Video BW**

Video bandwidth（VBW）is the lower pass filter after the IF filter which can make the display trace noise more smoothly. It is very useful to detect the signal which level is near to the noise. To improve the filter's effect, user should manually set the VBW to smaller than 1/10 of the RBW. When VBW is set to "Auto", the VBW will change with RBW. The VBW filter need establish time too and the smaller its value is, the more time it needs.
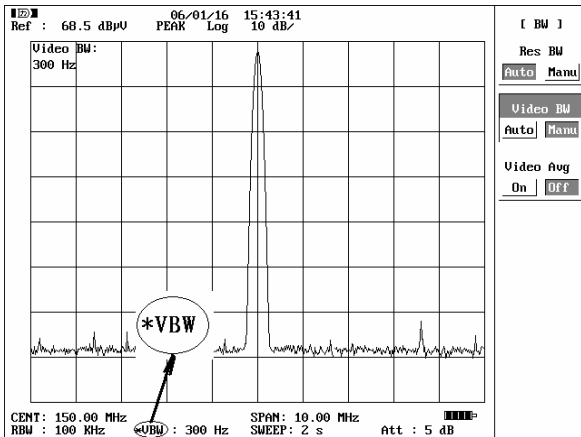
（a）VBW=100KHz

(b) VBW=300 Hz

Figure 3.16 The Influence of VBW

In Figure 3.16 (b), there is a "*VBW" on the screen, in which "*" indicates that VBW parameter is in "Manu" state now. The same * will use to indicate the "Manu" of RBW, sweep time, attenuator too.

(3)Video Average：

(a) Video Average Off

(b) Video Average On

Figure 3.17 Video Average

Set the "Video Avg" to "On", then the spectrum will calculate the average value of current trace and previous traces values. The default state of "Video Avg" is "Off".

Turn on the "Video Avg" can smooth display trace as VBW but the sweep time will not be increased with it. When "Video Avg" set "On", the default detector mode will be changed to "Sample" mode automatically. (See also 3.3.4)

The default average time is 100. Press number key after setting the "Video Avg" to "On" can change the average time.
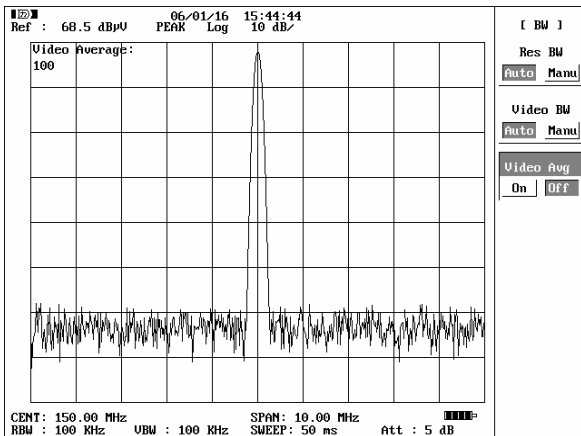
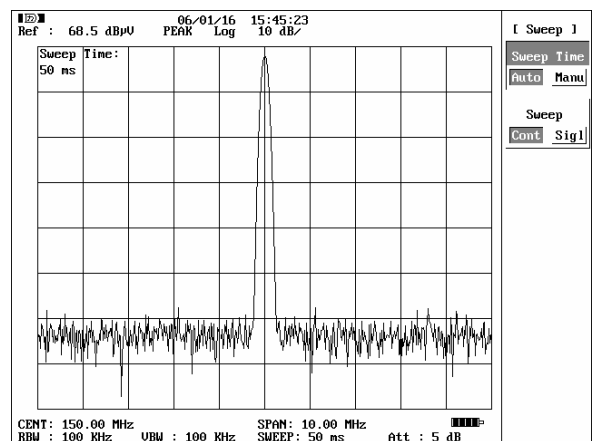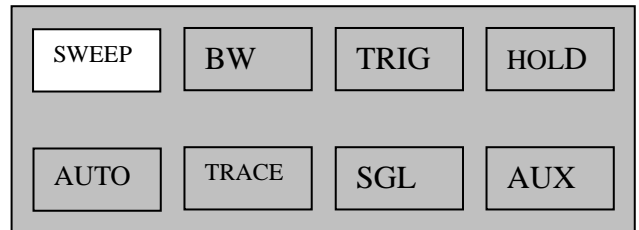## 3.2.2. Sweep Mode, Sweep Time and Hold

Figure 3.18 Sweep Menu

Press **SWEEP** on the front panel, the sweep menu will appear:

（1）Sweep Time

Sweep time depends on span, RBW and VBW. If the sweep time can't fulfill the requirement of span, RBW and VBW, the system will give the prompt "UNCAL". User can set the "Sweep Time" to "Manu" and input the wanted time.

（2）**Sweep Mode**

SWEEP	BW	TRIG	HOL
AUT	TRACE	SGL	AUX
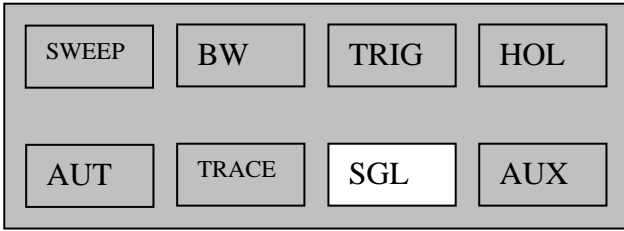
There two sweep modes; one is continuous (Cont) and the other is single (Sigl). The default mode is continuous mode. If user wants to set the sweep mode to single mode, user can set the "Sweep" soft-key in Figure 3.18 to "Sigl" state or press the **SGL** key to activate a single sweep at the same time the menu shown as Figure 3.19 will appear. Press **SGL** key again can activate another single sweep. If want to change the state to "Cont", user can select the "Sweep" soft-key and set the state of it to "Cont".
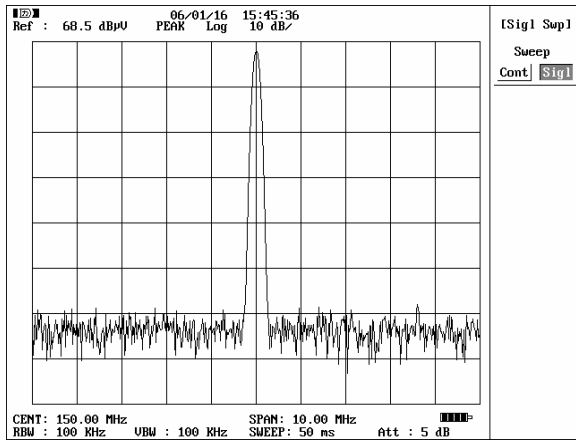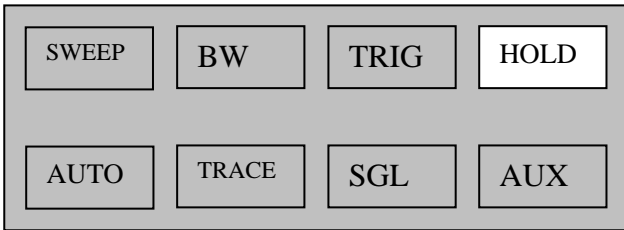
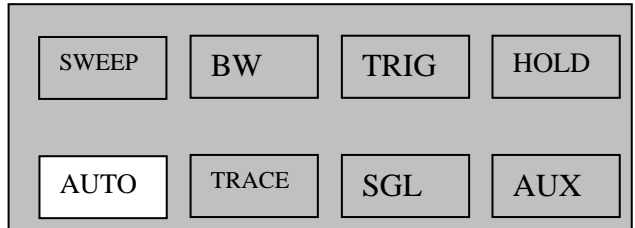

Figure 3.19 Single Sweep

（3）**Hold**

SWEEP	BW	TRIG	HOLD
AUTO	TRACE	SGL	AUX

Pressing the **HOLD** key, the wave display on the screen will be frozen. Press the key again to activate the wave again.

Note：

In "Hold" state, no sweep mode can be activated no matter "Cont" or "Sigl".

3.2.3. Auto

SWEEP	BW	TRIG	HOLD
AUTO	TRACE	SGL	AUX

Press the **AUTO** key, in the submenu of it, which is shown as Figure 3.20 user can select the "Auto/Manu" state of "Res BW", "Video BW", "Atten", "Sweep Time" or "CF Step". By pressing "Auto All" soft-key, user can set all these parameters state to "Auto".
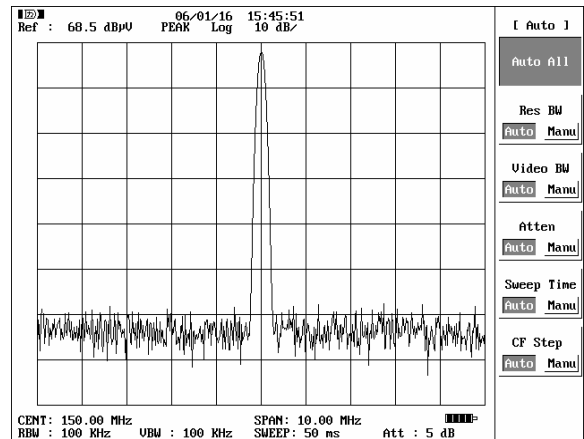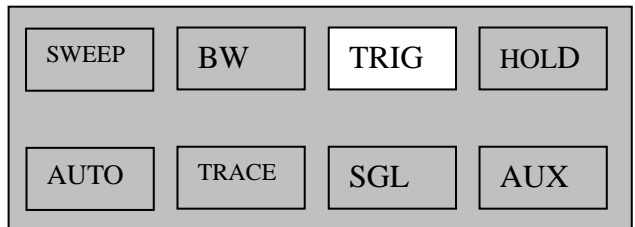

Figure 3.20 "Auto" Menu

3.2.4. Mode of Trigger

SWEEP	BW	TRIG	HOLD
AUTO	TRACE	SGL	AUX

Press **TRIG** key, then the submenu of it will appear:
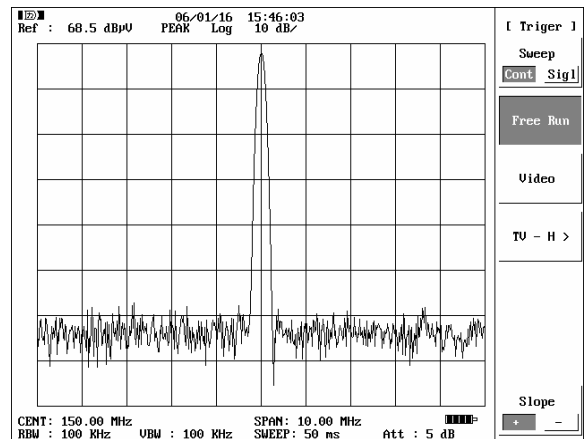
Figure 3.21 Trig Mode

(1) Free Run

This is the default mode of the system.

(2) Video

In this mode, user can change the level of start trigger by rotating the knob. Also user can select the up/down slope trigger by pressing the "Slope" soft-key and setting it to "+/-".

(3) TV-H （option 3）

In this mode, the TV line trigger is selected. User can change the line and set the field to "Odd/Even". Also user can set the standard to "M/N" or "B/D/G/I/H/K/K1/L".

3.3.Basic Usages

In this section, we will introduce the operations of marker, peak and trace etc.

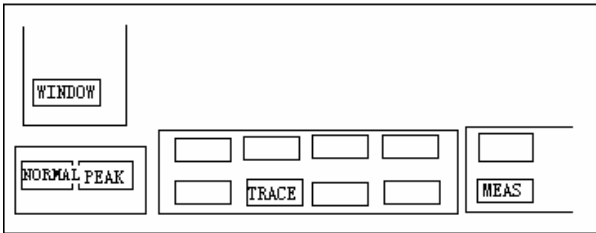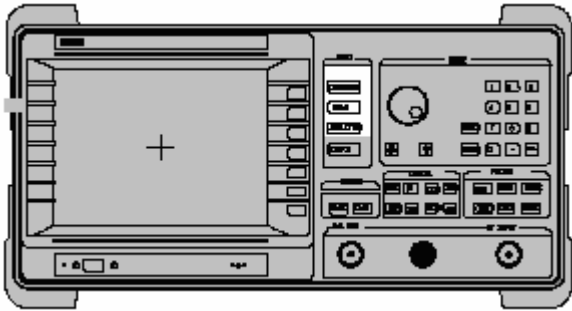## 3.3.1. Mark Operation

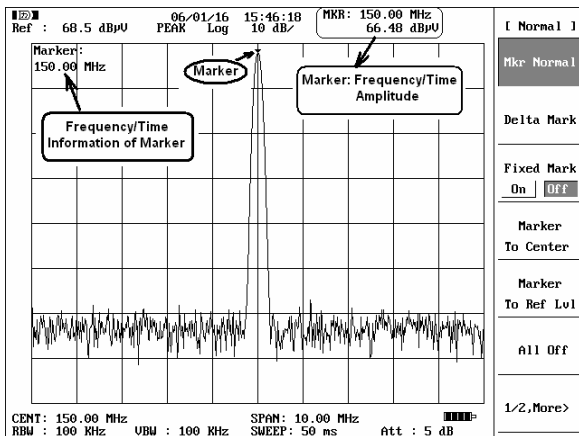Press **NORMAL** key，the submenu of it will appear:

Figure 3.22 Marker Menu

After press the "Mkr Normal" softkey, if there is no marker on, the system will automatically set the normal marker to on. If there have been some "On" markers, the state of these markers will remain unchanged.

(1) Normal Marker

After pressing "Mkr Normal" soft-key or pressing **NORMAL** key while no marker is set "On", the normal marker will appear on the screen. And at the same time the amplitude and frequency/time information of this marker will be displayed on the up-right of the screen. When the span is set to zero, the wave display on the

screen is a time domain wave, so the abscissa is changed from frequency to time. The start time is zero and the stop time is equal to sweep time. The displayed marker information is changed to time too.

The abscissa of the marker can be changed by three methods:

1. Press "Up/Down" cursor. The step change of this method is 1/10 of span.

2. Rotate the knob. The step change is 1/500 of the span.

3. Manually input the number user needed.

When normal marker is "On", user can press "Mrk To Center"/"Mrk To Ref Lvl" to set the frequency/amplitude of the marked point to center frequency/reference level.
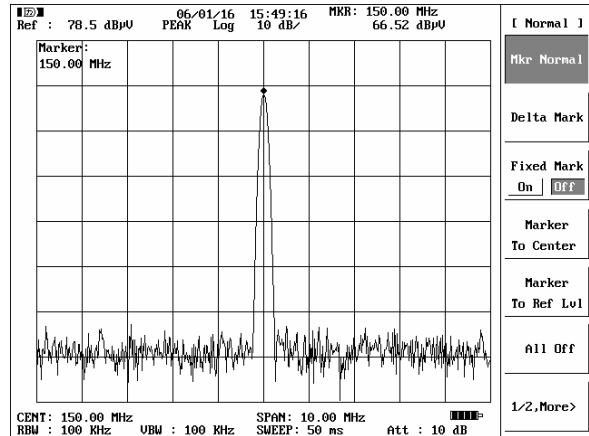
(a)   Before Press "Marker To Ref Lvl"
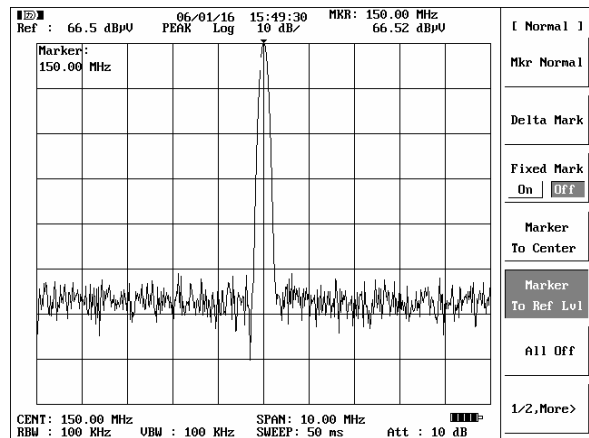
(b)   After Press "Marker To Ref Lvl"

(c) Before Press "Marker To Center"

(d) After Press "Marker To Center"

Figure 3.23 "Marker To Ref Lvl" and "Marker To Center"

(2) Delta Mark

After pressing this soft-key, two markers will appear on the screen. The start positions of these two markers are the same. Rotating the knob, pressing the "Up/Down" cursor or manually inputting the frequency value can change the position the second marker. The amplitude and frequency/time difference between two markers will be displayed on the up-right of the screen. The main function of "Delta Mark" is to compare two signals.
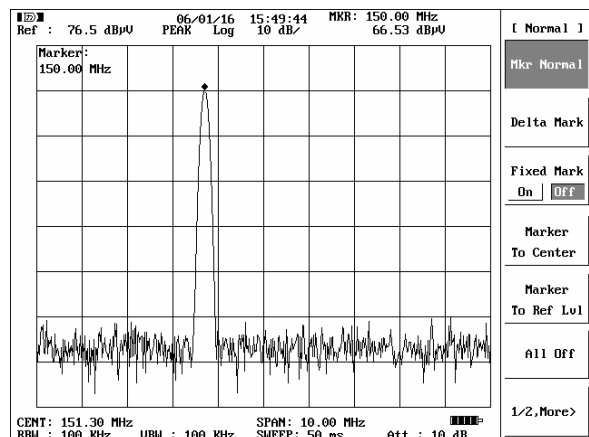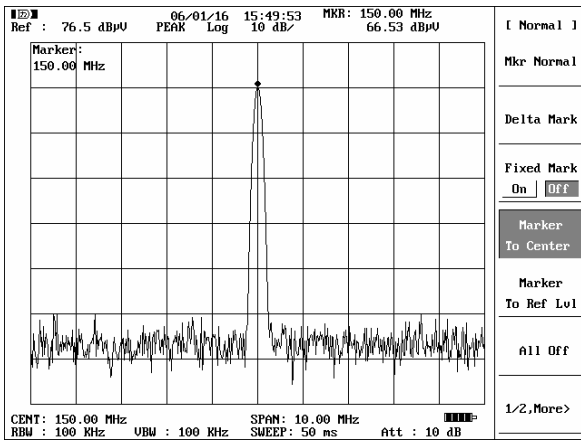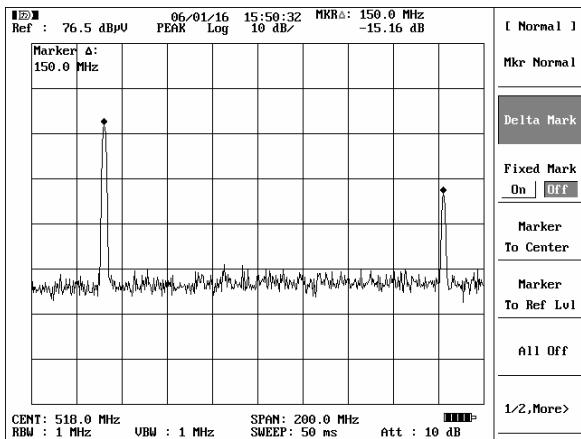

Figure 3.24 Delta Marker

(3) Fixed Mark

"Fixed Mark" is similar to "Delta Mark": the main function is also to view the deference of two markers and the method to change the position of the second signal is the same. But the first marker will be frozen after setting the "Fixed Mark" to "On", and its position will not change with the signal again except when the reference level or the frequency is changed (the absolute amplitude and frequency value of this marker is unchanged).

(4) Multi-marker and Marker Table

Press "1/2 More" soft-key，the second menu will appear：
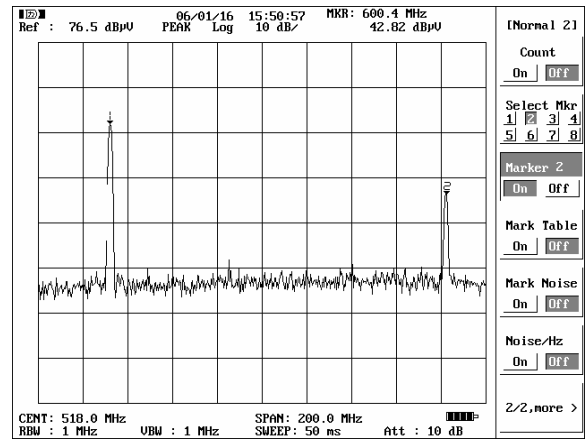
Figure 3.25 Multi-Marker

The instrument can display 8 markers simultaneously. After pressing "Select Mkr" soft-key, User can switch between these markers and set the "On/Off" state of it. For example: If the current marker is marker 2 and user want to change the state of marker 4, the operation steps are as follows:
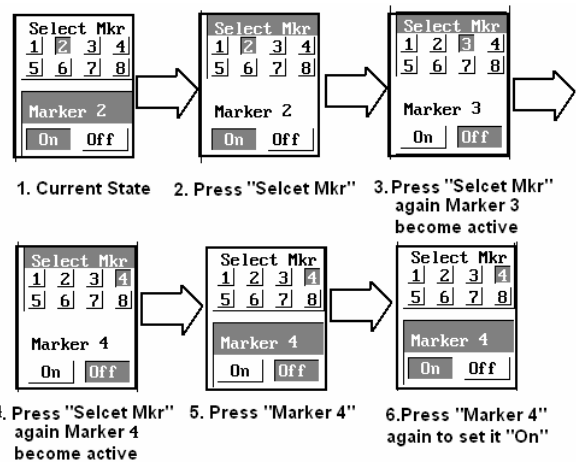
Figure 3.26 Multi-Markers Selection

After selecting the marker and set the state of it to "On", user can change the marker's position by the same way of changing "Normal Mkr".

"Mark Table" displays values of all active markers. (See Figure 3.25)
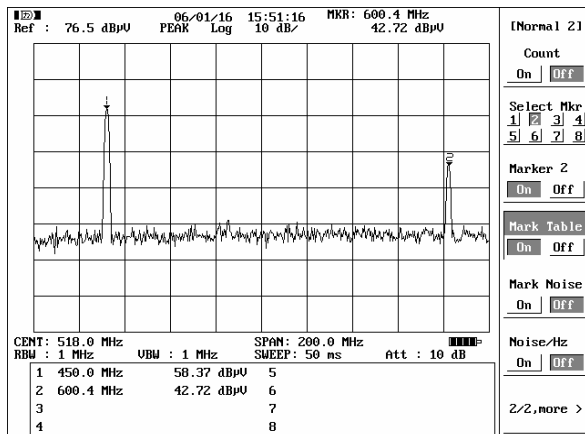
Figure 3.27 Marker Table

Note：

When switch between "Mkr Normal", "Delta Mark", "Fixed Mark" and multi-markers, the pre-marker will automatically set to "Off".

(5) All Off

Press "All Off" soft-key in Figure 3.22, all markers will be set to "Off".

(6) Count

Frequency count can give the accurate frequency of the strongest signal around the marker, which is working as a cymometer. The bandwidth of the counter is +/- 100kHz and the accuracy of it is Hz.

Note：

If the "Count" soft-key is set to "On", the displayed frequency will change from the frequency of marker to the frequency of the strongest signal around the marker.
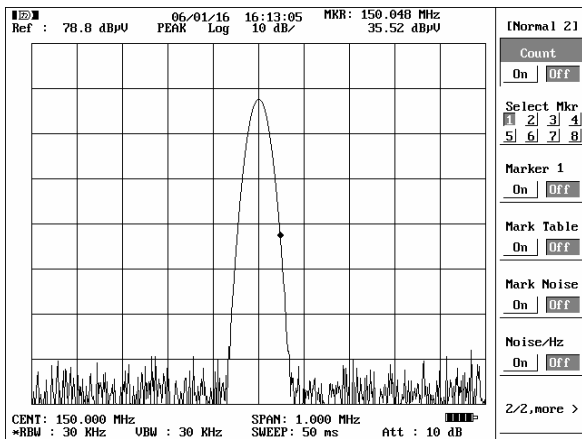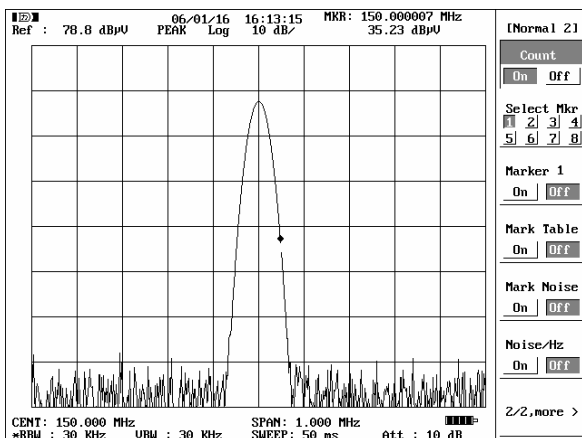

(a) Count "Off"

(b) Count "On"

Figure 3.28 Frequency Counter

(7) Mark Noise

Set "Mark Noise" to "On" state, then user can get the average power of the noise. It will take the place of the amplitude to display on the up-right of the screen.

(8) Noise/Hz

Set "Noise/Hz" to "On" state, the difference between current amplitude and the average noise power will display on the screen.

3.3.2. Peak Operation
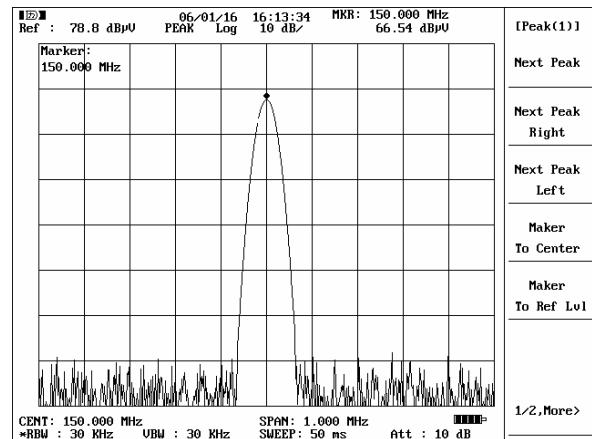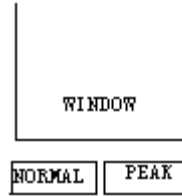
Figure 3.29 Peak Menu

(1) Peak Search

If there is no marker set to "On", the system will search the peak signal in the span and set marker on it when user press the **PEAK** key.

(2) Next Peak, Next Right Peak and Next Left Peak

Next Peak: Search for the hypo-peak value that is lower than the marked one.

Next Right Peak: Search for the hypo-peak value on the right side of current marker.

Next Left Peak: Search for the hypo-peak value on the left side of current marker.

(3) Marker to Center and Marker to Ref Lvl

When there is only one marker is "On", press "Marker To Center"/"Marker To Ref Lvl" can set the frequency/amplitude of current marker to center frequency/reference level.

(4) Peak Table and Peak Sort

Peak table has the similar format as marker table (See Figure 3.30). Press the "PK Sort" soft-key can sort the found peaks by "Freq" or "Amp". When set the "PK Table" to "On", the system will search 8 peaks and sort them with frequency or amplitude. The default state is by amplitude. The frequency/time and amplitude information of these peaks will display on the bottom of the screen. The peaks will change with the wave change.

Figure 3.30 Peak Table

(5) Peak Track

Set the state of "Peak Track" to "On", the system will search the "Peak" with the change of the wave automatically. Otherwise the peak marker will stay on the firstly searched frequency/time.

3.3.3. Multi-trace Function
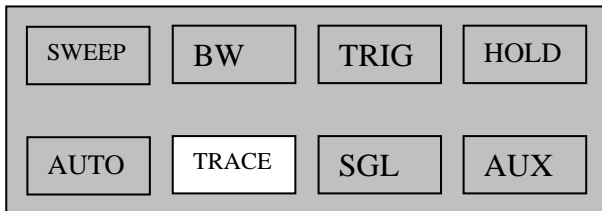
Press **TRACE** key, the submenu of it will appear which is shown as figure 3.31.

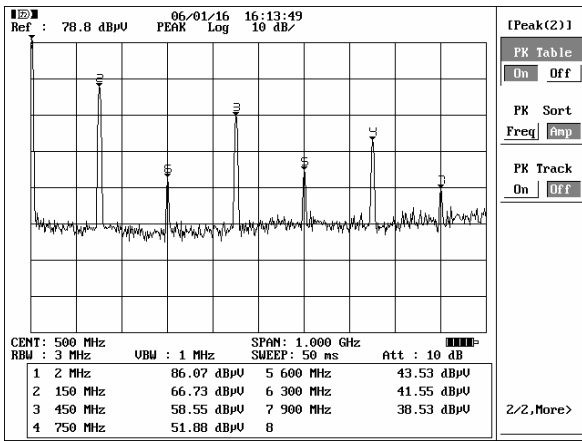There are three traces that user can choose A, B or C. User can switch between these trace by press "Trace" soft-key. What are called three traces are the different waves of the same input that only were viewed in different time and different parameter settings.
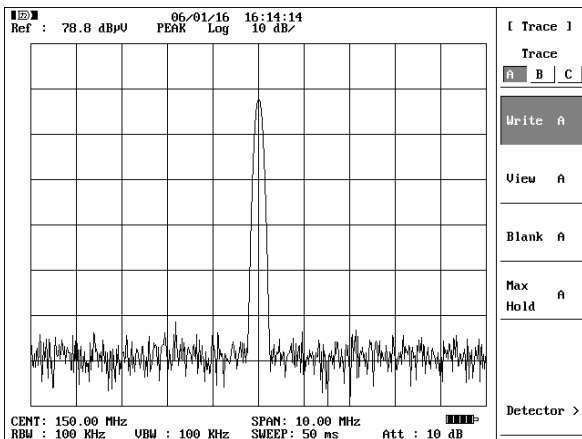
Figure 3.31 Trace Menu

(1) Write

Write is the default state of all the three trace. In this mode the wave is continuously refreshed.

(2) View

Press "View" soft-key, the trace will be hold. Change to other trace and user can see the changes of the wave with the different parameter settings. Figure 3.30 gives an example of "View" soft-key. The trace A is in the "View" state and the reference level of it is 68.8 dBμV. When

change the reference to 88.8 dBμV, only the trace in "Write" Mode changed, while trace "A" keeps unchanged.
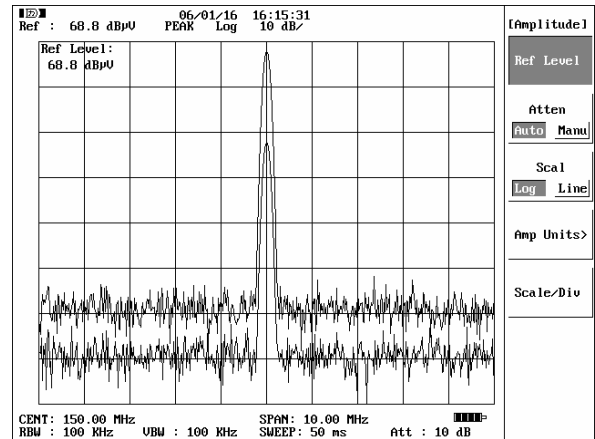
Figure 3.32 The Example of "View"

(3) Blank

Erase the display of the selected trace.

(4) Max Hold

"Max Hold" mode is similar to "Write" Mode, but the wave shown on the screen will keep the largest value comparing with the history after "Max Hold" mode is selected.

3.3.4. Detector Mode

The Instrument has 6 detector modes, which are shown as figure 3.31.
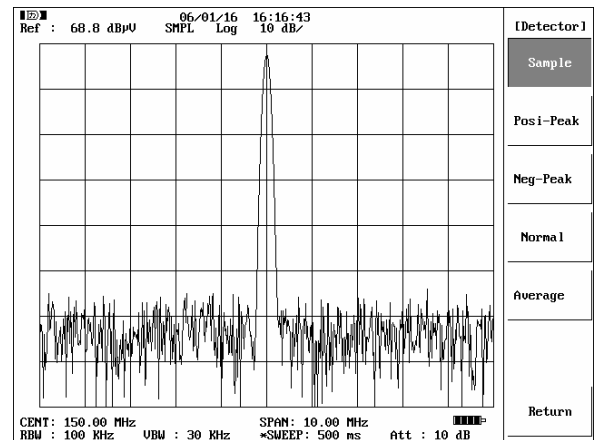
(a)   Sample

(b)   Posi_Peak
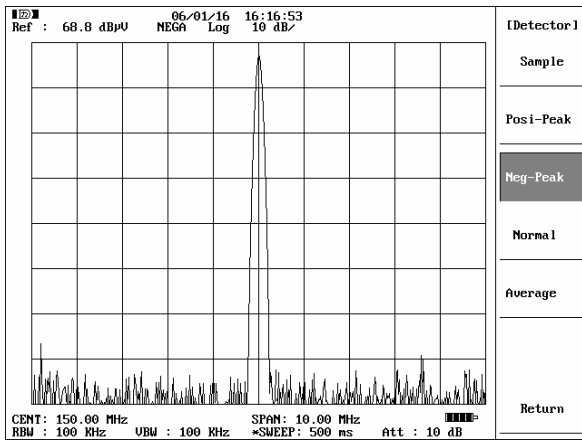
(c)   Neg-Peak
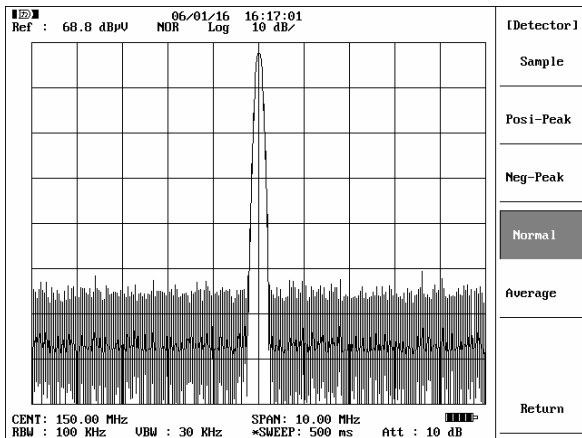
(d)   Normal
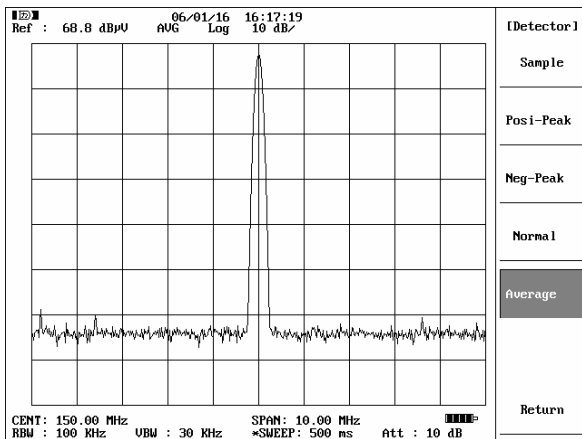
(e)   Average   (f)   Quasi-Peak

Figure 3.33 Detector Mode

(1)Sample

Detector sample the data point in the middle time of VBW filter output of each sweep point, and displayed it. It is more suitable to view the noise.

(2)Positive-Peak

Detector sample the positive value of VBW filter output of each sweep point, and display it. If the sweep time is long enough, this detector can put out the maximum envelop of the modulated signal.

(3)Negative-Peak

This detector is opposite to "Posi-Peak" detector. The output of it is the minimum envelop of the signal.

(4)Normal

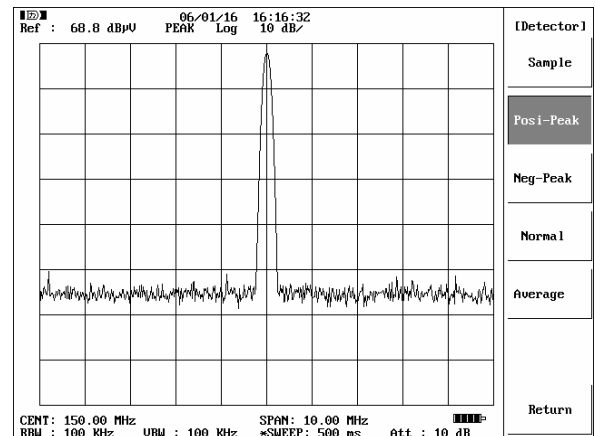This detector continuously samples the positive-peak value of the signal, while alternately samples the positive and the negative peak value of the noise and display it.

(5)Average

The output of this detector is the average value of all detected values for each sweep point.

3.3.5.   NdB PTS
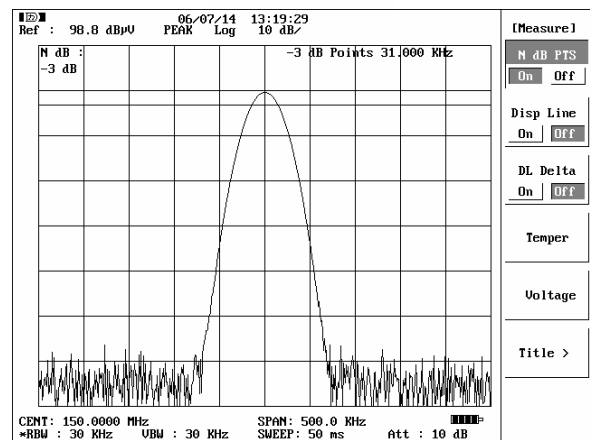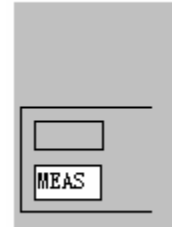
Figure 3.34 Measure Menu

Press **MEAS** key on the front panel, the submenu of it will appear which is shown as figure 3.34.

Press "N dB PTS" soft-key and set the state of it to "On". The system will display the information of N dB bandwidth that indicates the character of current used filter on the up-right of the screen. The default value is -3dB and the output is the frequency difference of two points which amplitude is 3dB lower than the peak value.

3.3.6.   Display Line and Display Delta

Set "Disp Line" to "On", a red line will appear in the mid of the screen and the amplitude of it will appear on the up-right of the screen.

After setting "Disp Line" to "On", set "DL Delta" to "On". At that moment the wave will be memorized and the amplitude difference of current wave and the memorized will be displayed around the "Disp Line".
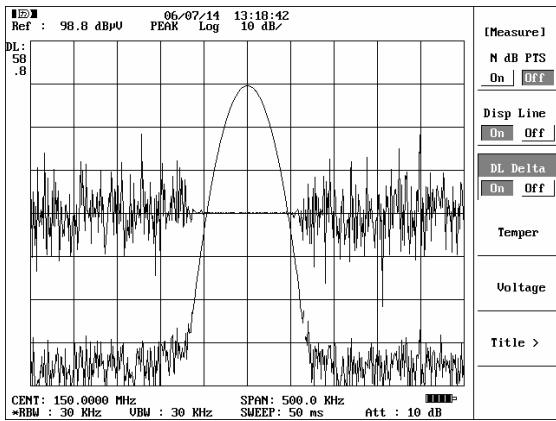
(a) "Disp Line" in Default Position
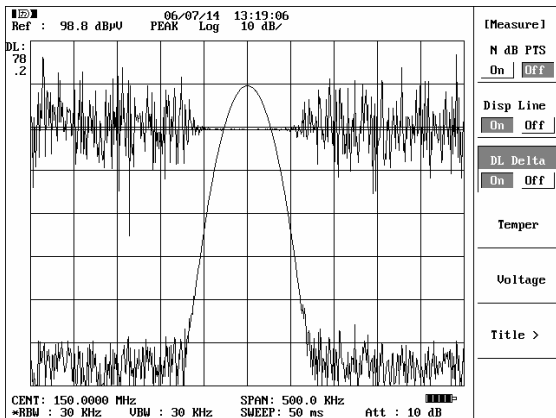
(b) After "Disp Line" Shift

Figure 3.35 Display Delta

The default position of "Disp Line" is in the mid of the screen. User can change the position of it by rotating the knob or pressing the "Up/Down" Key.

3.3.7. Temperature and Voltage

Press "Temper/Voltage", then user can get the temperature/voltage message of the analyzer.

When temperature over the set value, the fan will run and the flag of it "F" will appear on the down-right of the screen.

When the voltage is lower than the set value, the system will give an alarm. If the voltage keeps on descending, the system will automatically power off.

The system detects the temperature and voltage of the analyzer every 5 minutes.
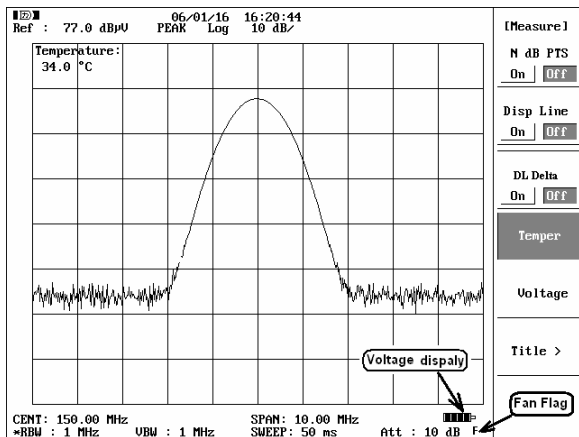
Figure 3.36 Temperature and Voltage monitor

3.3.8. Title

Press "Title>" soft-key, the submenu of it will appear:
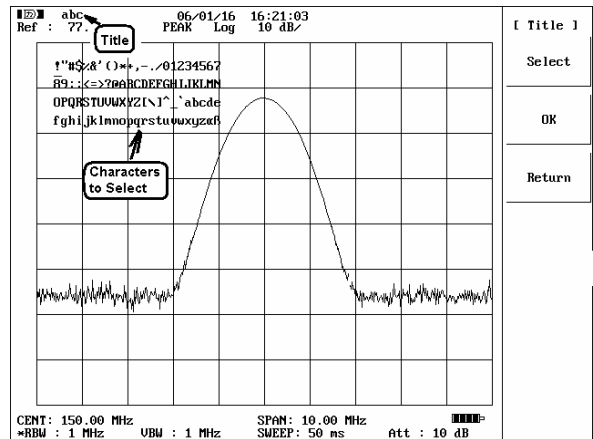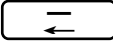
Figure 3.37 Title input

Rotating the knob, the cursor under the character will move with it. Set the cursor down the character user want to choose, then press "Select". The selected character will appear in the title position (see Figure 3.37). Press [⎯⎯] key can erase the unwanted character. Press "OK" to finish the title input. Otherwise the input will be lost after pressing "Return".

3.3.9. Double Window

By this function, user can view the integral information of the signal in one window while observe the detail of it in the other window.

Press WINDOW key on the front panel, two windows of the same size will appear which is shown as figure 3.38.
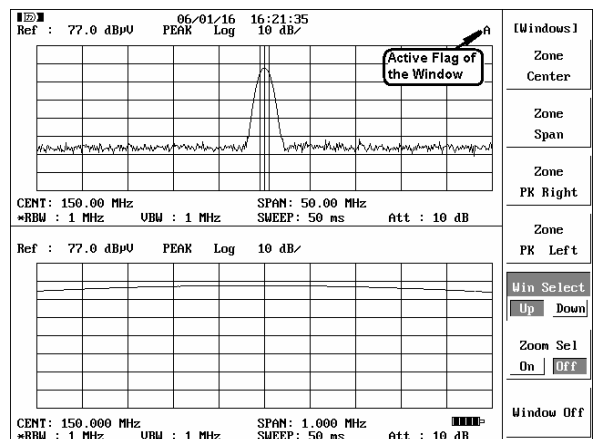
Figure 3.38 Double Window Menu

The upper window shows the wide BW information of the signal, the parameter settings of this window is the same as the single window. The nether window shows the information of the zone plotted by two blue lines. Two windows can take different settings. So the nether window can be the stretch of the upper window (When the two blue lines are set in the sweep span of the upper window). Also they can work separately too. The start and stop frequency of the nether window can be set outside the sweep span of the upper window. At that time the two blue lines will lays at the leftmost or rightmost side of the upper window.

User can watch the spectrums with different settings. But at one time there is only one settings of the window can be changed. We call this window the active, of which there is a sign "A" displayed on the up-right.

User can separately set the parameters of two windows such as reference level, sweep span, RBW, VBW, sweep time, center frequency etc.

Note:

"Window" function will be available only when the instrument is in "Spectrum Analyzer" mode.

1.   Zone Selection

Zone selected operations include "Zone Center", "Zone Span", "Zone PK Right" and "Zone PK Left".

The span and frequency of nether window will change with the change of the zone.

Note ：

1. The zone selection is valid only when the upper window is active.

2. After zone selection, the wave of nether window will not be refreshed at the time.

(1) Zone Center

The center frequency of nether window will change with the change of "Zone Center", while the span of it will be unchanged.

There are two ways to change the "Zone Center":

➤   Press "Up/Down" key: the step is 1/10 of the span.

➤   Rotating the knob: the step is 1/500 of the span.

User can take same ways to change "Zone Span", "Zone PK Right" and "Zone PK Left".

(2) Zone Span

The span of nether window will change with the change of "Zone Span". In some cases, the change of "Zone Span" will cause the RBW, VBW and sweep time changes of nether window.

(3) Zone PK Right/Left

Press "Zone PK Right/Left" soft-key to change the right/left limit of the zone.

2.   Window Switch

Press "Win Select" to activate the window user needed.

3.   Zoom Selection

Set "Zoom Sel" to "On", then user can zoom the active window to full screen.

Figure 3.39 Zoom Select "On"

4. Auxiliary Measurements

Main points of this chapter:

● **Channel Measurements**

● **Modulation Measurements**

● **Input Impedance**

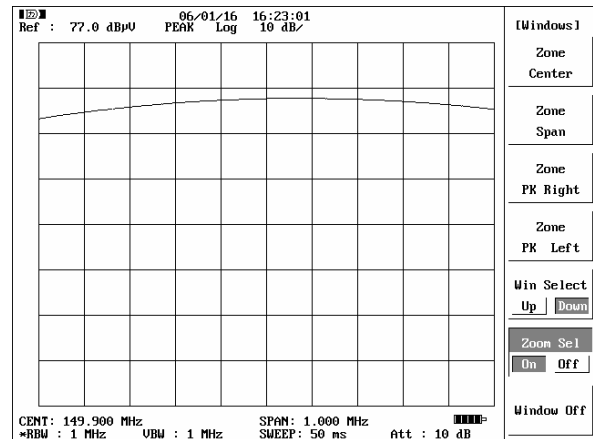● **Limit Lines**

When user press key (AUX) on the panel the Auxiliary Measurements Menu will appear on the right side of the screen, please look at the Figure 4.1 below:
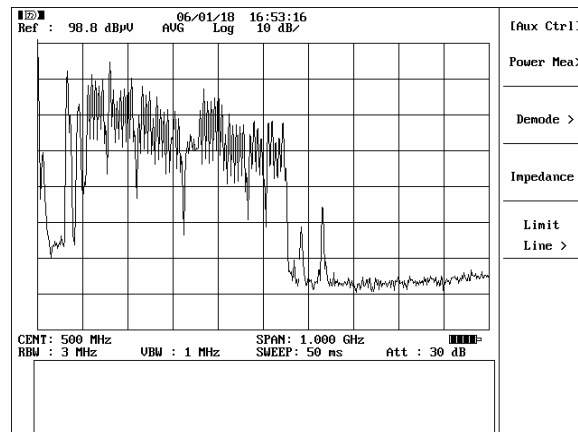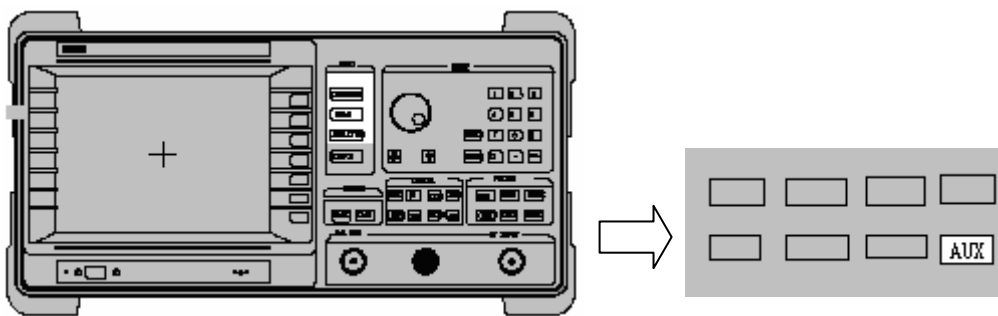

Figure 4.1 Auxiliary Measurements Menu

4.1.Channel Measurements

4.1.1. Unit Exchange

The contents we introduced before focus on the level measurement of the signal. Of course, we can measure the channel power with spectrum analyzer. The units usually used in spectrum analyzer are : dBm、dBmV and dBμV , which denote the level value. Please see the relationship of these units in table 3.1. In fact, we use the units dBm to denote the power value. In the following we will talk about the relationship between dBm and dBmV :

dBm is defined by A＝10×log(P/P0) , where P0 is the reference power and P0=1mW , P is the power under test.

dBmV is defined by A＝20×log(V/V0) , where V0 is the reference voltage and V0=1mV , V is the voltage under test.

Once the port Impedance is fixed on 50ohm or 75 ohm, we can exchange dBm and dBmV to each other. Though the physical definitions are different, the exchange is linear. User should notice that when we measure the signal power, the units we used are the same as the units of the reference level.

4.1.2. Channel Measurements Menu

When user presses the soft-key "Channel Measurements", the Channel Measurements Menu will appear like the figure below:
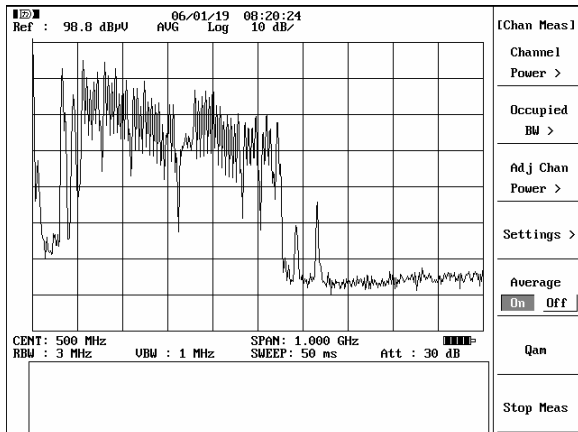
Figure 4.2 Channel Measurements Menu

In this menu, we can choose to measure the Channel Power, Occupied Bandwidth, ADJ Channel Power and modify other parameters, if the optional choice "Digital TV Analyzer" is selected, another soft-key "QAM" will appear in the menu, and user can directly come into the Digital TV analysis function from the Channel Measurements Menu.

Channel Power refers to the whole power of the signal in certain span. After modifying the center frequency, user can modify the Channel Bandwidth in "Settings" menu. After user press the "Settings" soft-key, the "Settings" Menu will appear which is shown as figure 4.3:
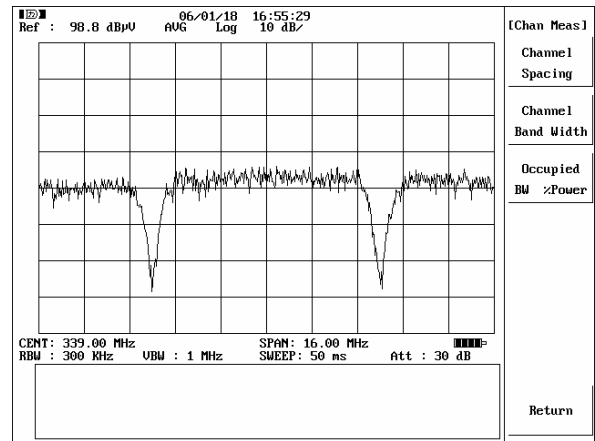
Figure 4.3 Channel Settings Menu

In this menu, user can modify the Channel Spacing, Channel Bandwidth and Occupied BW %Power.

In Channel Measurements function, user can modify the Channel Bandwidth manually. Otherwise it will take the default value 8MHz. In order to measure accurately, the scan span is fixed on two times of the Channel Bandwidth. After finishing these settings, it will return to the Channel Measurements menu and the Channel Power Menu will appear as figure 4.4, if you press the soft-key "Channel Power",

Before measure the "Channel Power" of the selected channel, analyzer will automatically test the total power of all the signals and set the state of attenuator and preamplifier. And during the testing process, the analyzer will real-timely monitor the tested value of channel power. If the value change is more 5dB, the analyzer will check the total power again.
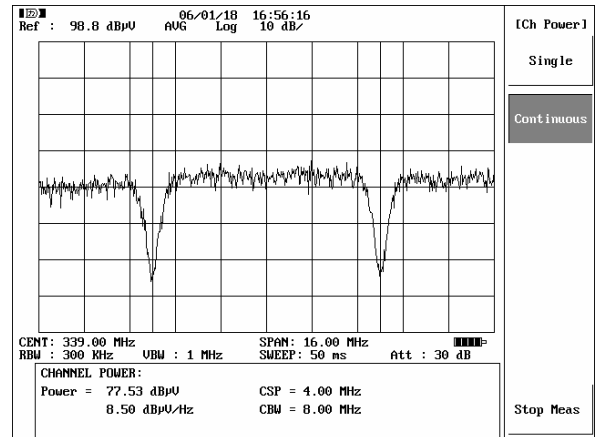
Figure 4.4 Channel Power Menu

In Figure 4.4, the area between the two lines is the Channel Bandwidth, and in the little window at bottom, the Power represent the overall power of the channel under test, the CSP represent the Channel Spacing, the CBW represent the Channel Bandwidth. Also user can use single scan or continuous scan function by selecting the soft-key "Single" or "Continuous".

Note：

If user wants to use other measure functions, user should exit the Channel Power menu by press soft-key "Return" to return step by step, otherwise it will show no response to user!

4.1.3. Occupied Bandwidth

Occupied Bandwidth is the frequency range, which represents certain percent of the whole power. In Channel Measurement Menu, user can press soft-key "Setting" to modify the "Channel Spacing" and "Occupied Bandwidth %Power" manually. The default of "Channel Spacing" is 4 MHz, and 99.9% for "Occupied Bandwidth %Power".

In Channel Measurement Menu, when user presses soft-key "Occupied Bandwidth", the "Occupied Bandwidth" Menu will appear which is shown as below:
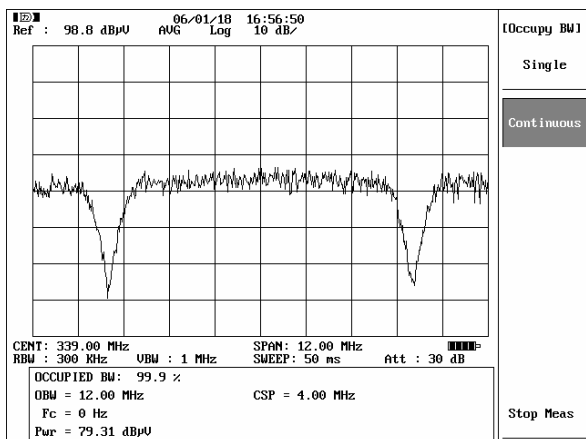
Figure 4.5 Occupied Bandwidth Menu

In order to measure accurately, the scan span is fixed on three times of the channel Spacing. The analyzer scans the setting span and calculates the total power firstly. Secondly find the greatest signal point, and set the difference of this signal frequency and the center frequency as "Fc" and display it on the screen. Finally little by little expand the power integral span around the greatest signal, until the equation the integral power =total power*"Occupied BW %Power". The integral span is the OBW that display on the screen. As same as the "Channel Power" measurement, user can use single scan and continuous scan function by selecting the soft-key "Single" and "Continuous".

4.1.4. Adjacent Channel Power

The bandwidth of adjacent channel is the same as the bandwidth of the current tested channel. In Channel Measurement Menu, when user presses soft-key "Adjacent Channel Power", the Adjacent Channel Power Menu will appear that looks like below:
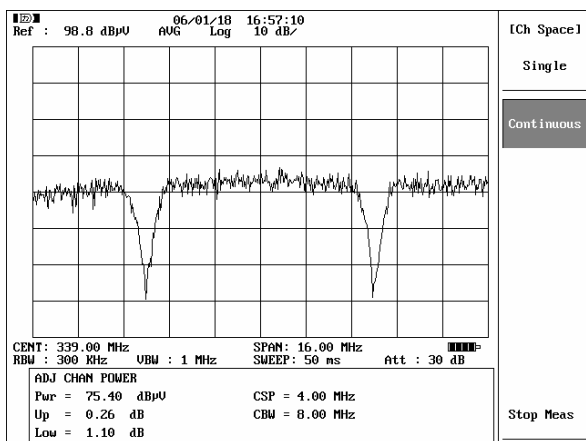
Figure 4.6 Adjacent Channel Power Menu

4.2. Demodulation Measurements

4.2.1. Demodulation Mode

In Auxiliary Measurements Menu, user can press soft-key demodulation to enter the demodulation Menu, and then user can press related soft-keys to select AM demodulation or FM demodulation, the default is AM demodulation.

4.2.2. Listen On

Once user select Listen On, the main window display the waveform after demodulation, and the information window at the bottom display the volume, user can use rotate knob to change the volume, meanwhile user can change the center frequency also. The following figure shows the Listen On state.
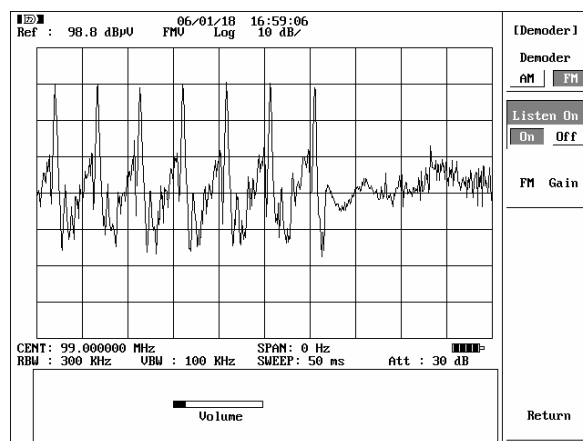
Figure 4.7 Listen On

4.2.3. FM Gain

FM Gain is the gain of the signal that after demodulation. Once user presses soft-key "FM Gain", user can change the value by using the up-cursor, the down-cursor or the knob, it provides 100K、50K、25K、12.5K.

4.3. Input Impedance

Once user presses soft-key "Input Impedance", it will display the input impedance of this instrument, 75ohm or 50 ohm. The following figure display the Input Impedance Menu.
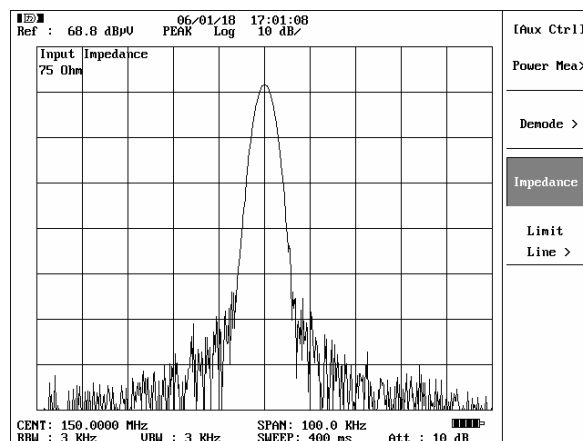
Figure 4.8 Input Impedance Menu

4.4.Limit Line

In Auxiliary Measurement Menu, if user presses soft-key "Limit Line", the Limit Line Menu will appear:
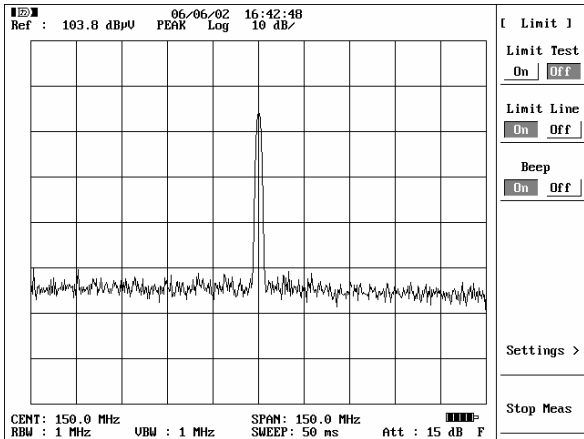
Figure 4.9 Limit Line Menu

User can use Limit Line function to monitor the signals. User can select beep on or off to make the analyzer give alarm or not. User should edit the limit line table firstly according to the actual demand. After pressing the "Settings" soft-key, the settings menu will appear:
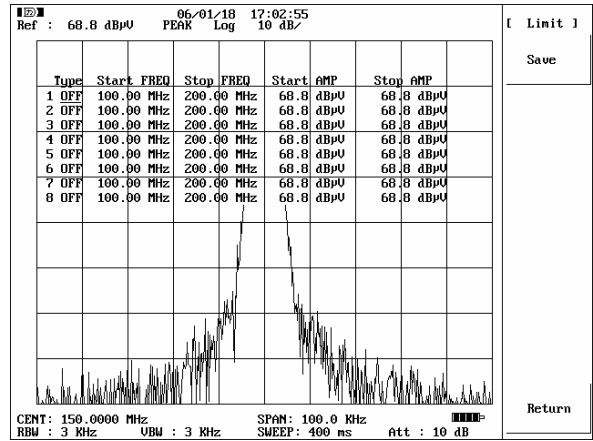

Figure 4.10 Edit Limit Line

From the Figure 4.10 we can know that user can edit eight items to set the "Limit Line". User can use knob to select one of them to edit. There are three types of "Limit Line", they are "MAX", "MIN" and "OFF". User can use up-cursor and down-cursor to change it. The "MAX" means the value that user set is the maximum value，if the value measured is higher than this set value，then it is unqualified，so does the "MIN", and if user select "OFF"，this "Limit Line" will be useless. User can modify the value of "Start FREQ", "Stop FREQ", "Start AMP" and "Stop AMP" by using the digital keys, user should press soft-key "Save" to save settings.

5. CATV Analyzer (Option 1)

Main Points of this Chapter：

● **Channel Measurement**

● **Scan Channel**

● **FCC Report**

● **HFC Measurement**
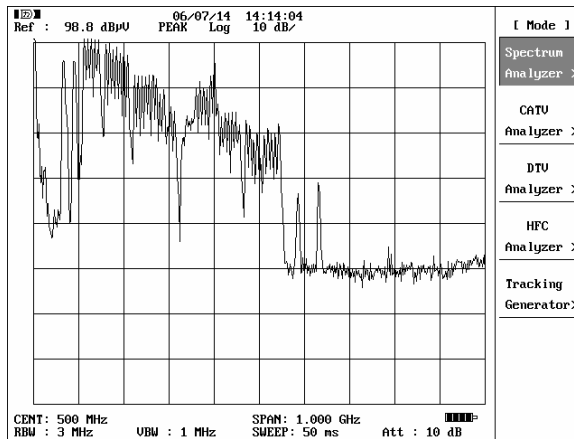
Figure 5.1 Mode Menu

Press "CATV Analyzer" in the Mode Menu to enter the CATV Test Mode:
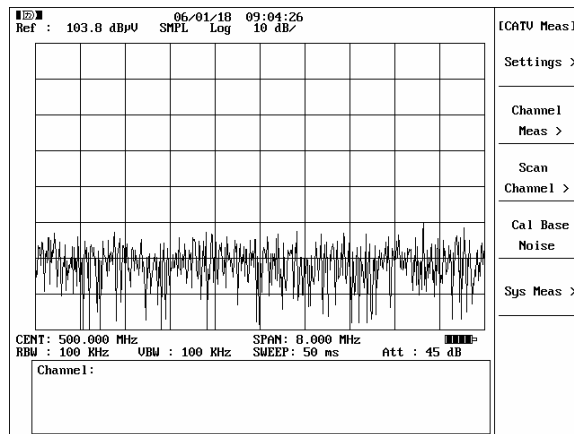
Figure 5.2 CATV Root Menu

5.1.CATV Standard and System

There are many different TV standards in use around the world, defining in detail the base band and RF structure of the signal, but for the broadband engineer and technician the key parameters are the bandwidth, the dimension of the lower (vestigial) and upper sidebands, and the frequency and amplitude relationships of the vision (luminance), color (chrominance) and audio sub carriers. In terms of these parameters, the vast majority of TV transmissions fall into just six categories, which are illustrated in figure 5.3.
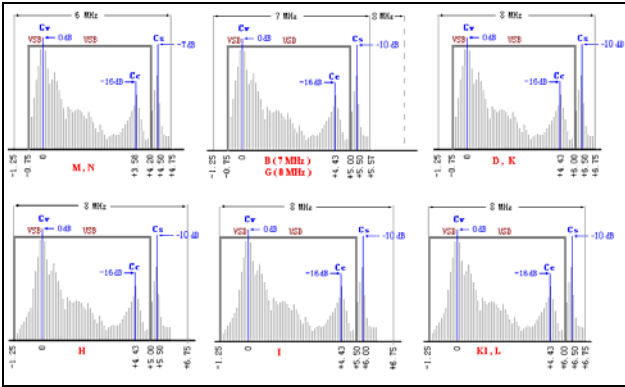
Figure 5.3 CATV Standard

Note that Figure 5.3 does not define such parameters as field frequency, line frequency, or color encoding technique, which distinguish the NTSC, PAL, and SECAM systems. The letters B, G, M, etc. are referred to as TV standards, and the encoding techniques (NTSC, PAL, etc.) are referred to as systems.

Standard	Can be used with these Systems
B	PAL, SECAM
D	SECAM
G	PAL, SECAM
H	PAL, SECAM
I	PAL
K	SECAM
K1	SECAM
L	SECAM
M	NTSC, PAL
N	PAL

Table 5-1 CATV Standard and System

When measuring or specifying CCN, it is important to define the bandwidth in which the noise is specified. The bandwidths for various TV systems are as shown in the following table.

System	I	B, G	K1,L	D, K	M, N
Video bandwidth* (* including lower sideband)	6.75	5.75	7.25	6.75	4.95
Noise bandwidth	5.08	4.75	5.58	5.75	4.00

Table 5-2 Video and Noise Bandwidth for Various TV Systems

5.2.Base Noise Calibration

Press "Cal Base Noise" in the CATV root menu, user can do the system base noise calibration.

The base noise calibration is to collect the analyzer local noise data overall span in order to calculate the Analyzer Noise Correction data which is used during some special measurements, e.g. CCN and CSO/CTB. So during this process user should cut off all input signals (use the 75Ω load if possible). It spends about ten minutes for this work.

5.3.Channel Table

Press "Settings" in the CATV root menu, and choose "Channel Table" in the sub-menu of it. Then all the TV plans will display on the screen.
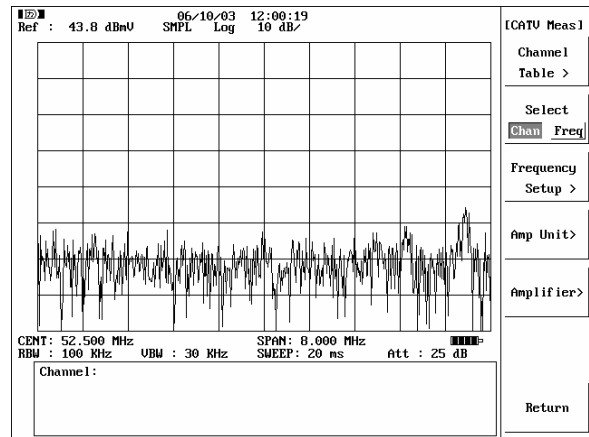
Figure 5.4 CATV Settings Menu
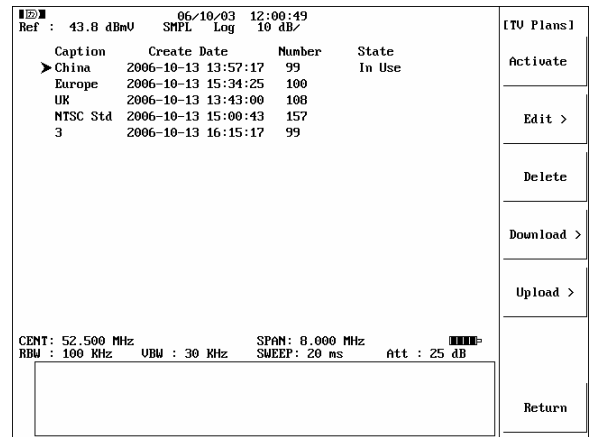
Figure 5.5 TV Plans menu

"Activate": Activate the selected TV plan. Run the knob or press the Up/Down key, then the arrow display on the left of the TV plan will move with it. Press "Activate" key, then the corresponding TV plan will be activated, and the state of it that display on the screen will change to "In Use".

"Edit": Press this key to edit the selected TV plan. The basic information of the selected plan will display on the information window, such as the plan title, total channel number, analog, digital and enabled channel number. In the submenu of it, user can choose to create a new channel, edit or delete the current channel.
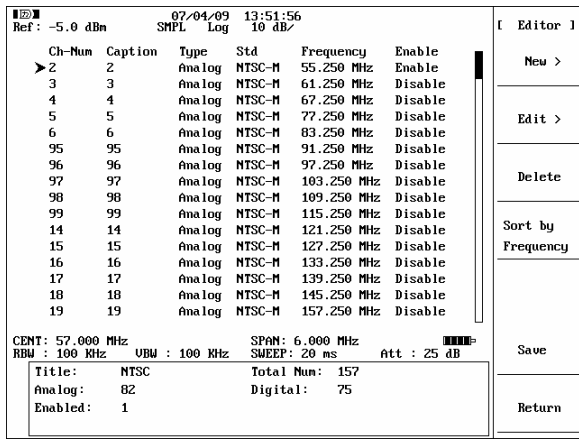
Figure 5.6 TV Plan Edit Menu

There are 55 items user can edit with a selected channel. To change the default value of these items, run the arrow to point to the item firstly. And then change it by the follow steps. There are totally four methods to change the current state of different items.

1. Directly Input by the number key and confirm the input by press **ENTER** key. "Channel No.", "Carrier/Center Frequency", "Symbol Rate", "CTB/CSO frequency Offset", "Equivalent Noise BW" and the line number such as "Depth Modulation Line", "CDLI Line" etc are inputted by this way.

2. Press **Up/Down** key to change between the permitted values. "Analog/Digital", "Standard", "Suppress/Modulate Type", gate on/off, field odd/even and the enable/disable state of the testing item are set by this method.

3. Change with the other items but can't change independently, such as "Audio 1 Offset", "Audio 2 Offset" and "Channel Bandwidth" that changed with analog TV standard.

4. The input way of "Channel Caption" is different to the others all. Make the arrow point to this item, press **ENTER** key, then there will be a green short line display under one character of the current channel caption. Press **Up/Down** key the corresponding character will change with it. Run the knob to move the short line to another character and change it. After input all the character, press **ENTER** key again to confirm the input.
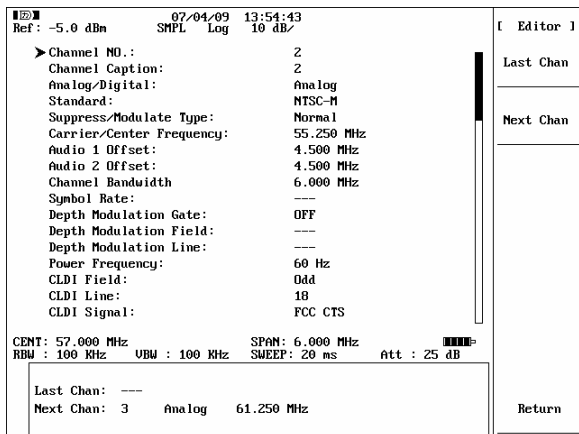
(a) Page One
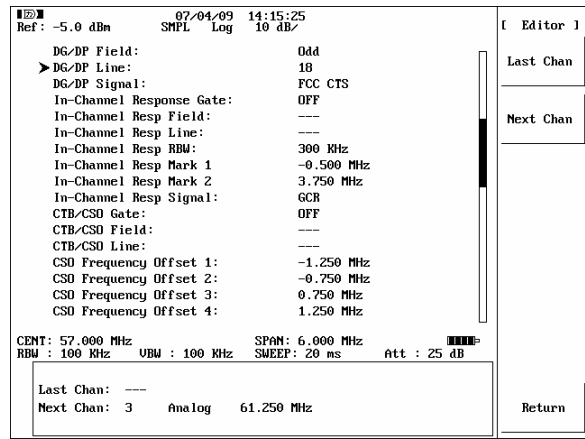
(b) Page Two
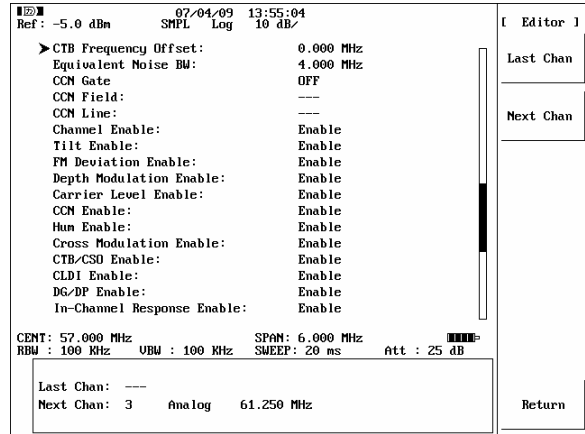
(c) Page Three
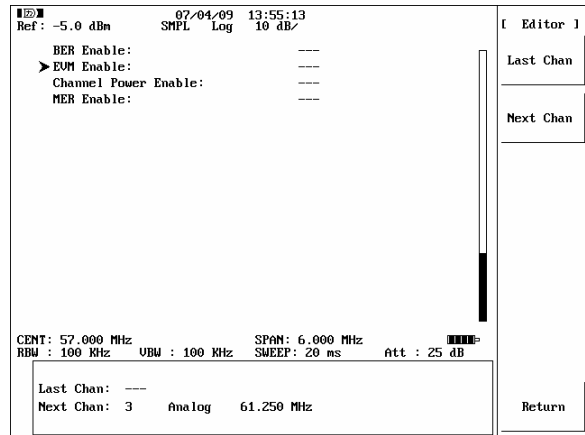
(d) Page Four

Figure 5.7 Channel Items

"New": Create a new channel. After the settings of all the items, press "OK" to confirm the new plan definition or press "return" to quit the former input. If the input channel No. is the same with the already exist channel, the system will give the clew and keep the former channel No. unchanged.

"Edit": Edit an existing channel. Press "Last Chan/Next Chan" to enter the Last/Next channel. The arrow will stay on the current position of the Last/Next channel.
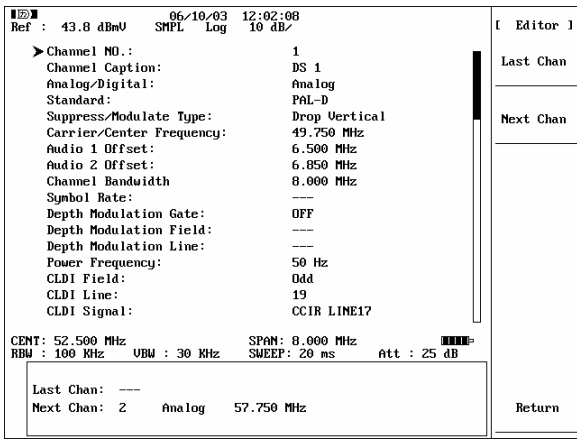
Figure 5.8 Channel Edit Menu

"Delete": Delete the selected channel. After press it, the system will give the note "Delete channel anyway". Press ENTER to confirm the delete operation or press ESC to cancel the command.

"Sort by Frequency": Sort all the channels by the carrier frequency of channels.

"Save" and "Return": After edit the TV plan, press "Save" to confirm the input or press return to exit the "TV Edit" menu.

"Delete": Delete the selected TV plan. The active plan can't be deleted.

"Download": Download the TV plan from the USB disk or the PC to the analyzer. The choice plan will display on the screen.

"Upload": Upload the TV plan to the USB disk or the PC.
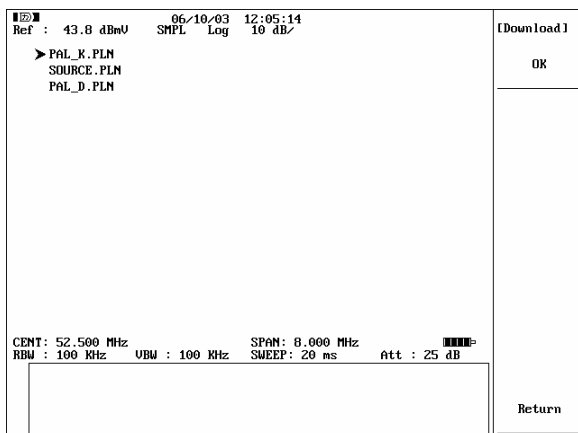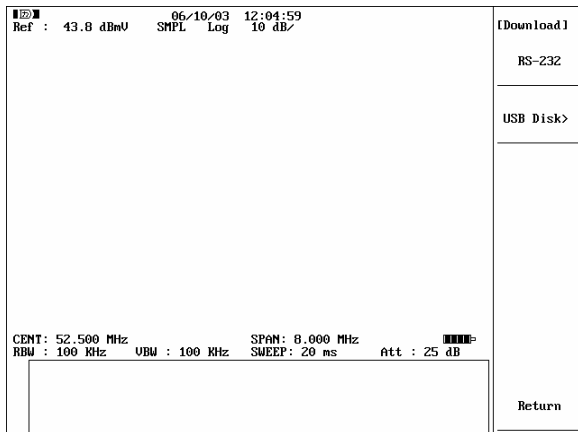
Figure 5.9 TV Plan Download Menu

All the channel settings will be used in the system measurement and will be set as the default mode of the channel measurement items. The "Enable/Disable" settings of "Channel Enable", "CCN Enable" etc will be used in the system measurement. The test result will show on the FCC report.

5.4.CATV Test Settings

In CATV settings menu which is shown as Figure 5.4, we can see that except "Channel Table", there are still four items need to be set before start the CATV testing.

"Select Chan/Freq": Choose the "Channel Select" mode. Inputting the channel by the channel no. that define in the active TV plan or the channel frequency directly is determined by the state of this soft-key.

"Frequency Setup": This is almost the same as channel definition. The only difference is that there is no channel no. and channel caption in the frequency setup. These settings will be called when the channel input mode is set to frequency mode.
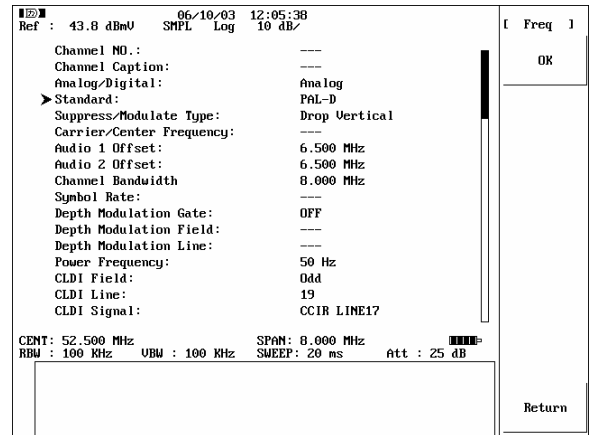
Figure 5.10 Frequency Setup Menu

"Amp Unit": Select the amplitude units that will be used in all of the CATV tests.

"Amplifier": Define the state of internal amplifier. When it is set to "Auto", in channel test, the analyzer will automatically set the amplifier to on/off according to the total channel power. While if it is set to "On/Off", the analyzer will only change the attenuator to adapt to the channel power and keep the amplifier state unchanged.
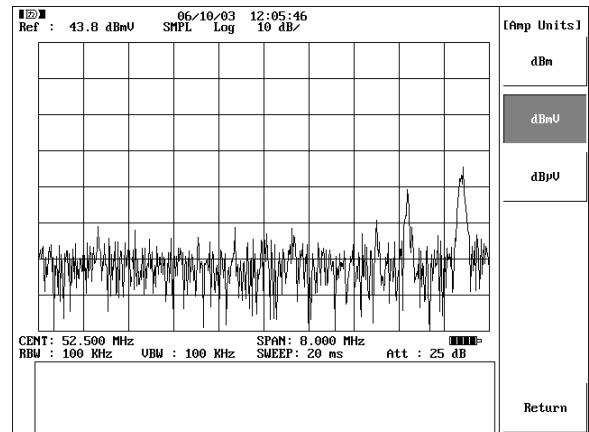
Figure 5.11 Amplitude Unit Menu
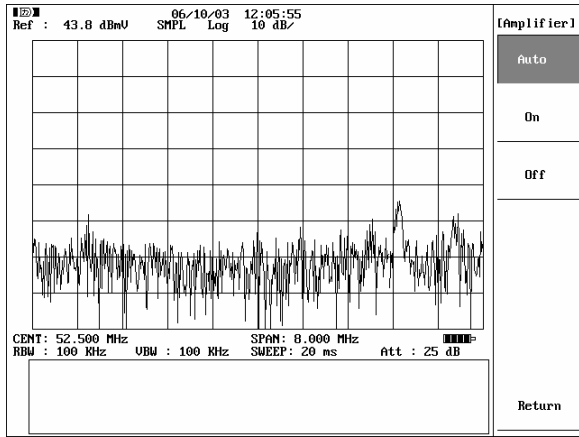
Figure 5.12 Amplifier Settings in CATV measurement
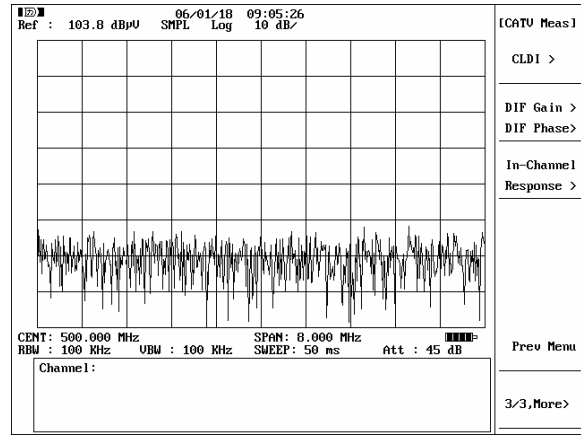
5.5.Channel Measurement

Channel measurement measures a single channel's characters.

Channel measurement mode support 12 measurement items which are shown as Figure 5.13.

（a） Page 1/3

（b） Page 2/3

（c） Page 3/3

Figure 5.13 Channel Measure Root Menu

5.5.1. Channel Select

User can input the channel number/frequency by inputting the digital number, turning the knob or pressing the up-down key.

Before channel measurement, user should select one channel with inputting a channel number or frequency point first. Otherwise an error message "#01 Please Input channel" will display on the screen and indicated to input channel firstly. After having specified the channel, user can start channel measurements.
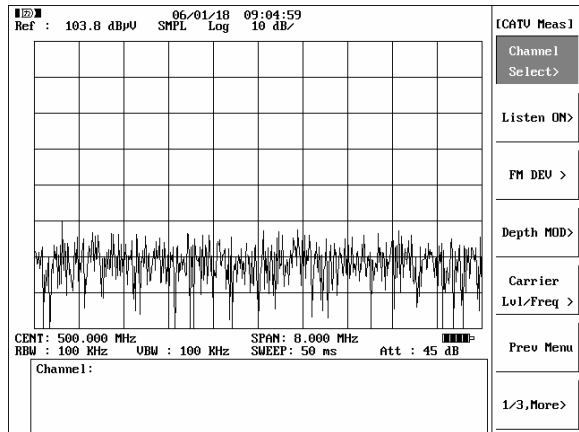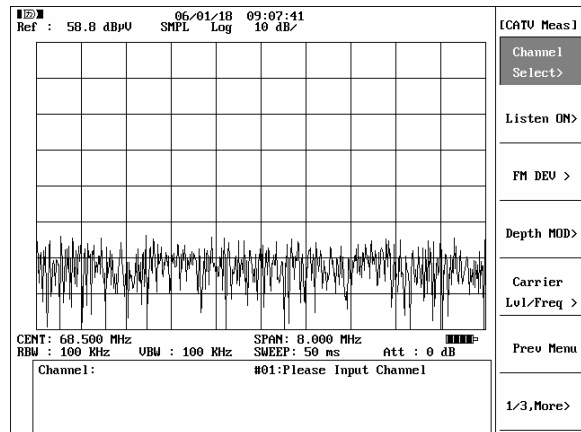
Figure 5.14 Notice User to Input Channel Number
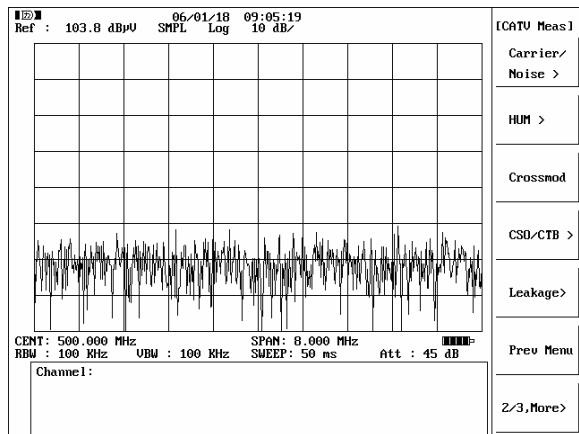
5.5.2. Listen On

Press "Listen ON" and user can listen to the sound of current channel. Turning the knob or pressing the Up/Down key can change the volume.
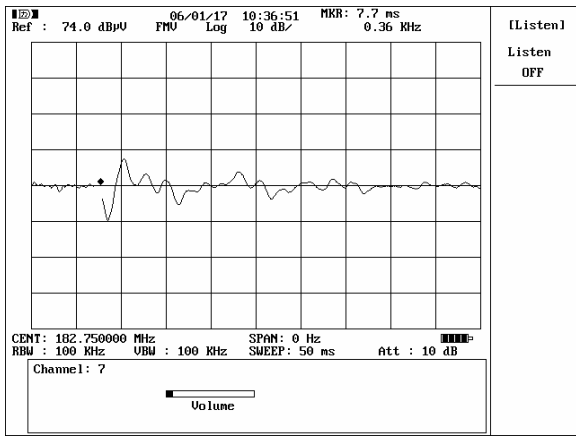
Figure 5.15 Listen ON
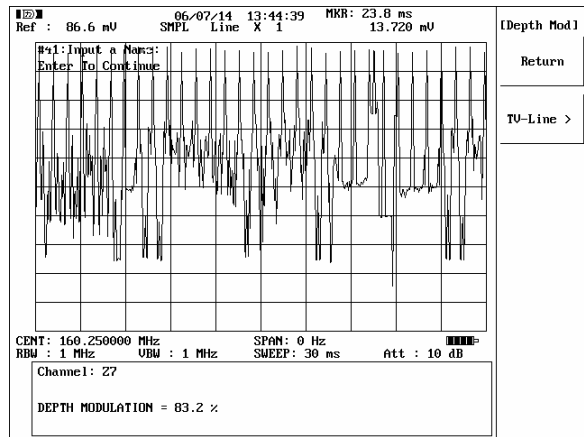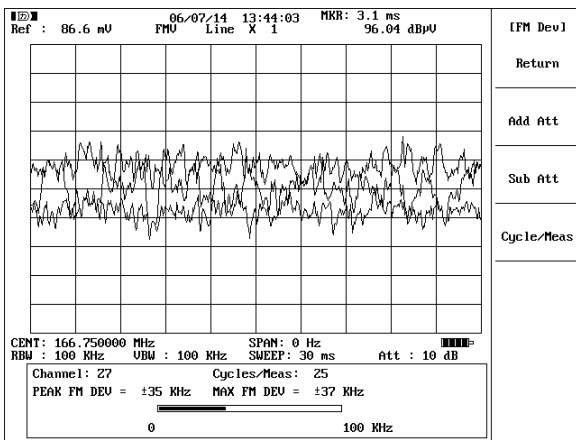
5.5.3. FM Deviation

Figure 5.16 FM Deviation

The FM Deviation function enable user to measure the FM deviation of the select channel. The information window shows the current deviation value and the maximum deviation. The default cycle of calculating the maximum data is 25 times. By pressing "Cycles/Meas", user can manually set the cycle.

While measuring the FM deviation, user can also listen to the sound by turning the knob or pressing UP/DOWN key to change the volume.

In channel measurement mode, "Sub Att" and "Add Att" if often used to change to current attenuation if user wants to.

5.5.4. Depth Modulation

The depth of modulation test measures the percentage of amplitude modulation (AM) on the video carrier.

(a) Normal Testing
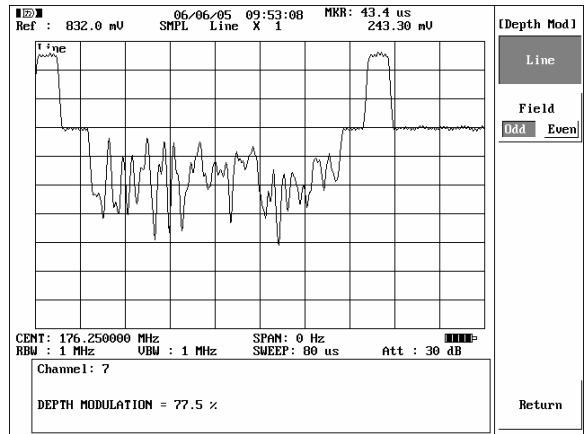
(b) TV-Line Testing

Figure 5.17 Depth Modulation

Depth modulation describes the carrier's depths of modulation. If user has option 3, user can press "TV-Line" to specify one line with white reference to perform a gate-based measurement.

For getting result precisely, every TV filed should have one line with white reference

5.5.5. Carrier Level & Frequency

The video carrier level test measures the amplitude and frequency of the current visual carrier and the amplitude and frequency difference between the visual and aural carrier.
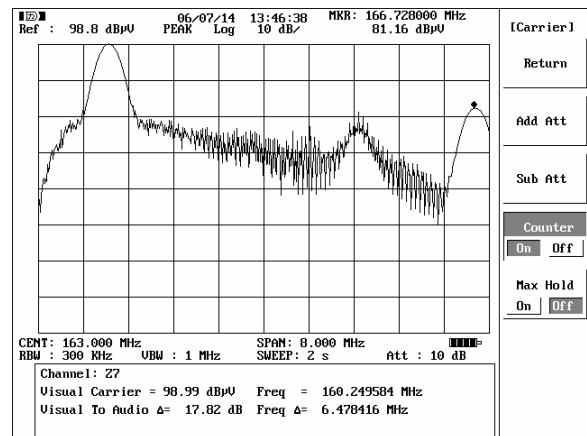
Figure 5.18 Carrier Level & Frequency

In the default status, only the amplitude information displays on the screen. But if user set counter on, the

frequency information will be displayed on the screen too. The frequency now is calculated by the counter with resolution of 1Hz.

If the carrier waveform is not stable enough, user can turn Max Hold on.

5.5.6. Carrier to Composite Noise

The result of the carrier-to-composite noise measurement is the ratio of the peak video carrier level (modulated or unmodulated) to the noise measured in one of the manners described below.

（1）Turn Off the Modulation

In menu shown as figure 5.13(b), press "Carrier/Noise" to perform the Carrier to Composite Noise measurement.

After initialization, system will show a message "Press Continue to go on" and "Please Remove Mod." If possible, user can turn off the modulation and then press "Continue" to go on the test. The information window displays the measure result and correction value.

If user cannot turn off the modulation, and press "Continue" soft-key, the measurement is not very precise.
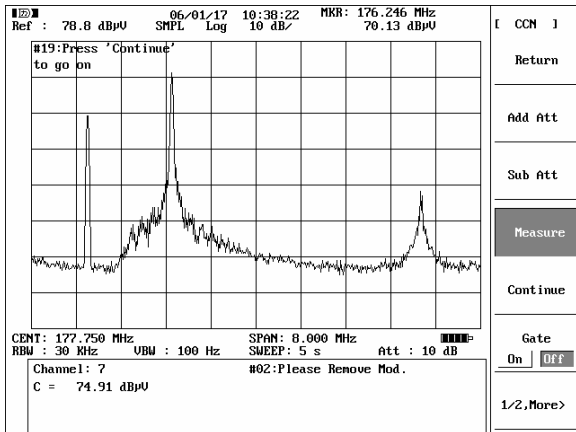
Figure 5.19 CCN Measure Step 1
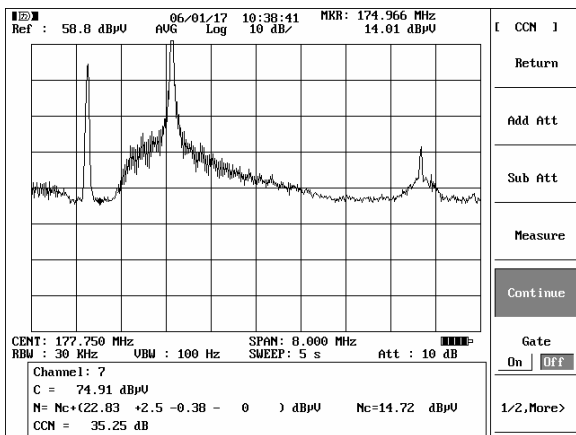
Figure 5.20 CCN Measure Step2

The current CCN value displays on the information window. Its calculate method is:

CCN= Carrier Amplitude – N;

N=Nc+ Correct to measurement BW + LOG detect Noise -IF Noise Equal. Pwr BW -Analyzer Noise Correction

Nc: Noise amplitude. It is the average value of the points around the minimum value which frequency is close by 1.25MHz down to the carrier.

Correct to measurement BW= 10*Log (Noise BW / RBW).

Noise BW is different according to different CATV standard. These values have been list on the table 5-2.

RBW is the resolution bandwidth when the CCN test is performed (30 KHz).

LOG detect Noise: It includes the Gauss envelope demodulation correction 1.05dB and the change correction 1.45dB of voltage to logarithm express. Its' value is 2.5dB.

IF Noise Equal Pwr BW: It is the correction of analyzer IF detector shape. To DS8821Q, this value is 0.38dB.

Analyzer Noise Correction: When the test result is close to the analyzer inherent noise, the result need to be corrected according to the difference of testing result and analyzer inherent noise.

Analyzer Noise Correction = $10 * \log (1 – 10 ^ (-\Delta / 10))$

For example when Δ=1dB, the Analyzer Noise Correction is 6.87dB. It can be ignored when $\Delta > 10$dB. The difference (Δ) will be calculated as 0.7dB when it is lower then 0.7dB.

（2）Gate Measure

With option 3, user can turn "Gate" on and measure channel's CCN non-interfering without turning off the modulation. User can select one line without modulation information to measure the CCN without interfering signal. The detail shows as figure 5.21 and 5.22.
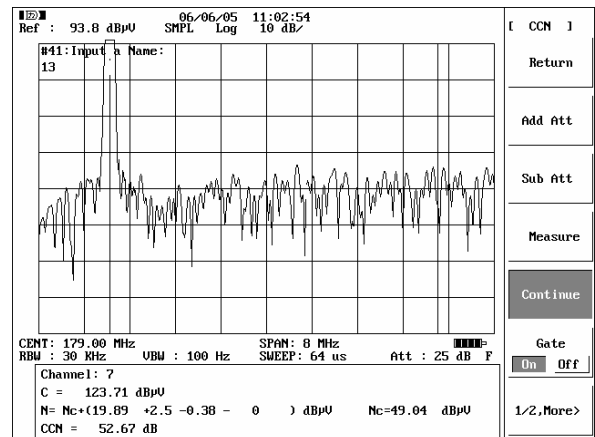
Figure 5.21 C/N Gate Measure
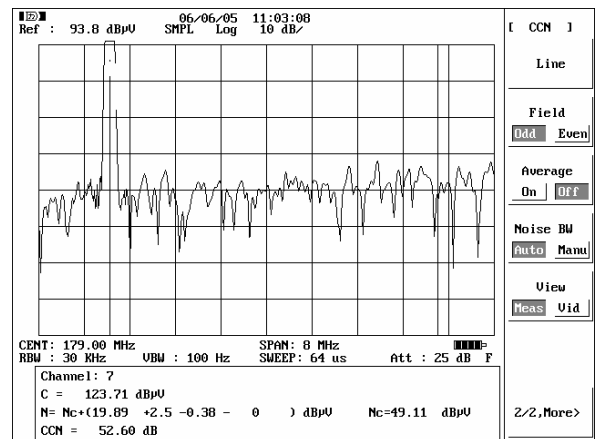
Figure 5.22 CCN Gate Settings
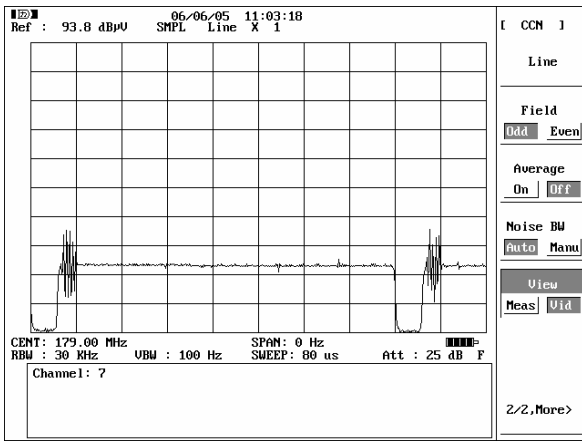
Figure 5.23 Testing Line View

Press the "View" soft-key and set it to "Vid" status. Then user can see the video waveform display of the line you have selected to do the CCN testing. Change it to "Meas" status again to go on the CCN testing.

If user wants to exit CCN test, press "Return" and user will get a message to notice user to turn on the modulation, and press "Return" again user will exit the CCN test.

5.5.7. HUM

The hum test measures the percentage of amplitude modulation for low frequency disturbance by measuring the peak-to-peak variation for total hum.
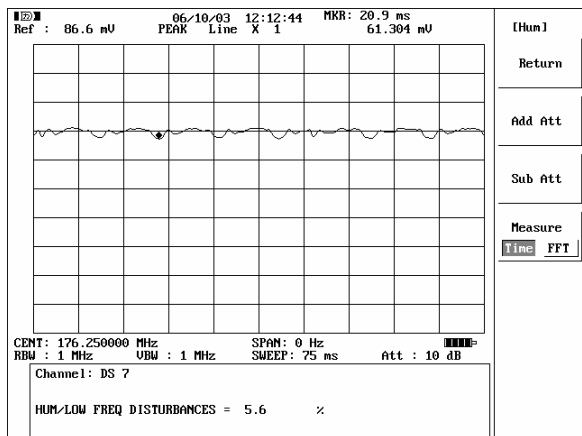
Figure 5.24 HUM

If the hum > 3%, it means the signal is not good enough. Turn off the modulation can get a more accurate value.

Set the "Measure" state to "FFT" mode, then the analyzer will perform a single sweep of 250 ms and performs a Fast Fourier Transform (FFT) on it to separate power line related components. 50 Hz, 100 Hz, 150 Hz, and 200 Hz are displayed in PAL standard, while in NTSC standard the marker point is displayed. This is intended to be used as a troubleshooting aid. A relatively high 50Hz (in PAL, 60 Hz in NTSC) level implies inadequate grounding or stray power utility neutral currents. A relatively high 100 Hz (in PAL, 120 Hz in NTSC) level implies poor filtering of a full-wave rectifier in a power supply.
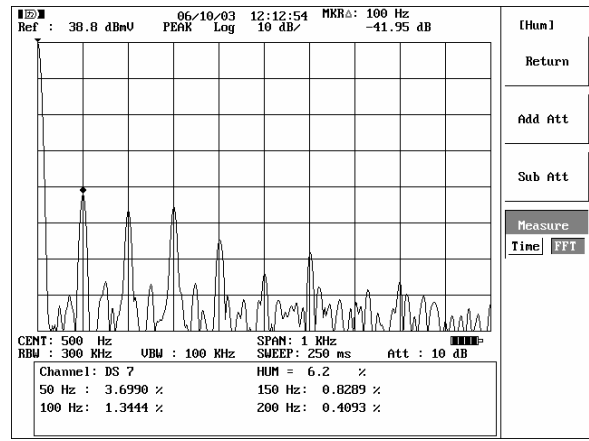
Figure 5.25 HUM FFT Result

5.5.8. Cross Modulation

The cross modulation test measures the first 15.7 kHz cross modulation sideband relative to the visual carrier of the channel.

Modulation must be turned off in order to perform this test. The analyzer is tuned to the carrier frequency and set the span to zero to produce the time domain waveform of the carrier signal. A FFT is performed on the time domain data and the magnitude of the 15.7 kHz offset signal will be measured relatively to the carrier level.
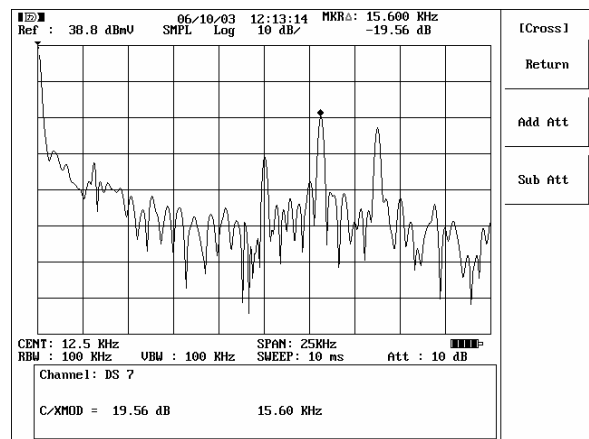
Figure 5.26 Cross Modulation

5.5.9. CTB/CSO

The instrument can provide the CSO/CTB measurement result in the same test view. There are two methods of measuring CSO/CTB describing as below.

（1）**Turn off the Carrier**

The CTB points are always on the visual frequency. So if user wants to measure CTB, the system will suggest user to turn off the carrier firstly.

The measure procedure is similar with the CCN measurement. Press the "Measure" soft-key. Then after auto system initialization, press "Continue" soft-key to go on the test.
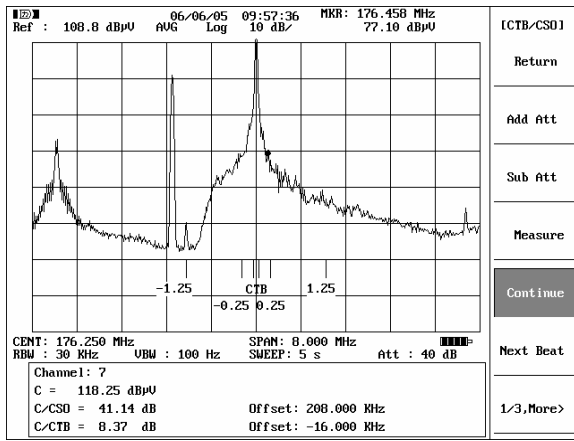
(a)
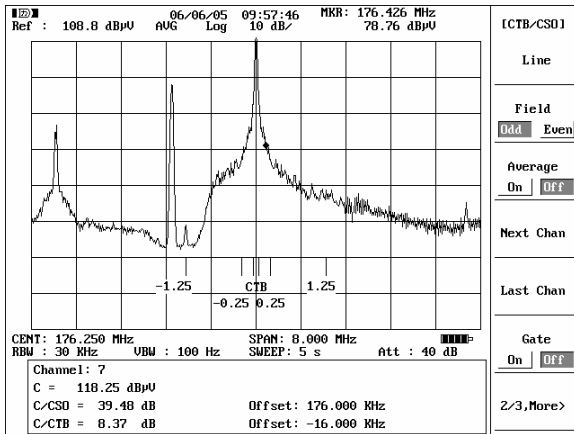
(b)
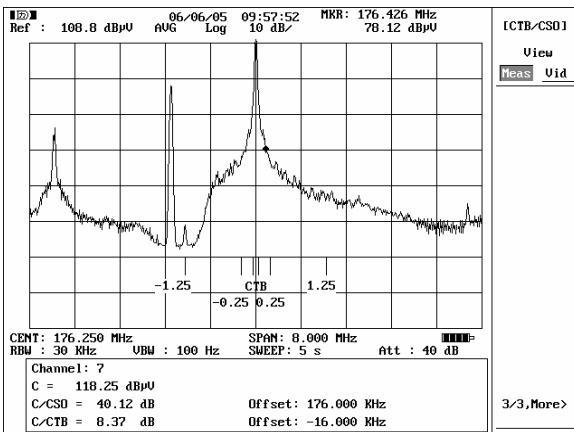
(c)

Figure 5.27 CTB/CSO Testing Menu

CSO points usually set at the frequency of ±1.25MHz or ±0.25MHz lower to the visual carrier in the PAL standard and ±1.25MHz or ±0.75MHz lower in the NTSC standard. Pressing "Next Beat", the marker will switch among these points. The marker can be set manually by pressing the UP/DOWN key or running the Knob.

"Next Chan" and "Last Chan" function enable user to measure CTB and CSO of adjacent channel. By this way user can find an idle channel, and firstly measure the carrier amplitude of its' adjacent channel that contains signal, and then measure the CSO/CTB in the idle channel. Then user can get an estimation of the system CSO/CTB without turning off the carrier.

Be similar with CCN, if user wants to exit CTB/CSO test, user should press "return" twice.

(2) Gate Measure

With option 3, user can measure CSO and CTB without turning off the carrier. User can select one quiet line of the vertical blanking interval to test CSO and CTB. But to test CTB, it requires a hardware blanking switch in the head end to absent the influence of the carrier. In this way, user can check the selected video line the measure using by pressing the "View" soft-key.
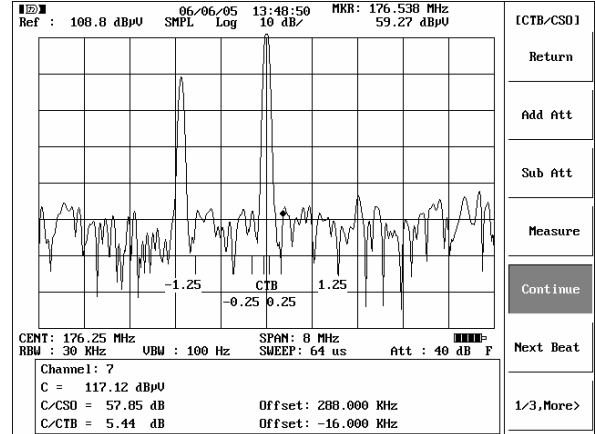
Figure 5.28 CTB/CSO Gate Measure

5.5.10. Leakage
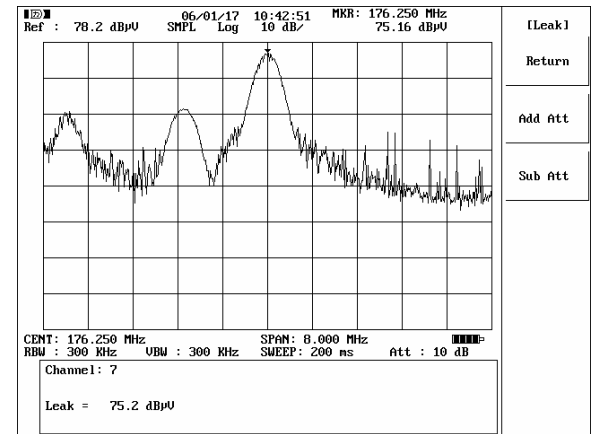
Figure 5.29 Leakage

Leakage is radiant signal from the cable to the air that cause by the off normal disconnection of the distribute system.

When testing leakage, user should set the antenna close to the possible leak point of the cable. The distance should be less than 3 m and the antenna should be parallel to the cable. Then tune the antenna to get a maximum value of the leakage.

5.5.11.Chrominance-to-luminance Delay Inequality (CLDI)
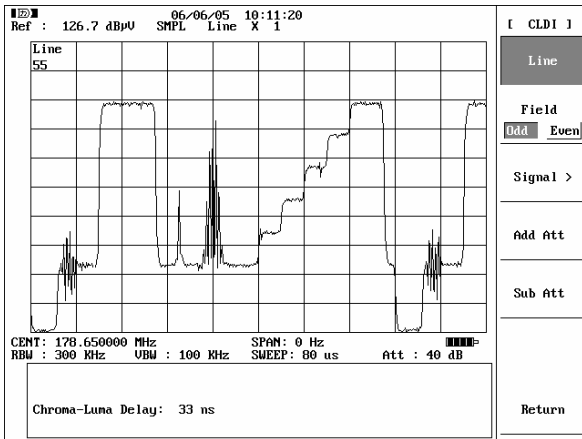
Figure 5.30 CLDI Measure

With option 3, user can measure the CLDI. The chrominance-to-luminance delay inequality measures the time delay between the low frequency luminance component and high frequency chrominance component of a modulated pulse in the composite test signal. There four signals can be used to test CLDI. In PAL standard, CCIR Line 17 and UK ITS 1 are recommended, while in NTSC standard, the FCC Composite Test Signal and the NTC-7 Composite Signal can be used.

Because there is a pre-distortion in the testing signal, an offset of 170ns is added to the result.
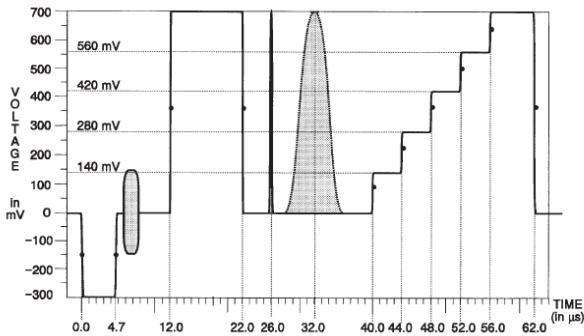
(a) Matrix Signal – CCIR Line 17
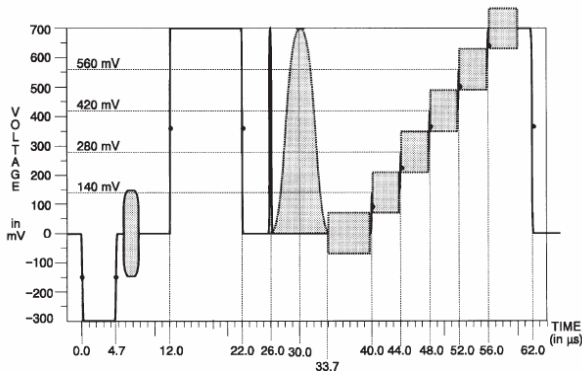
(b) Matrix Signal – UK ITS 1
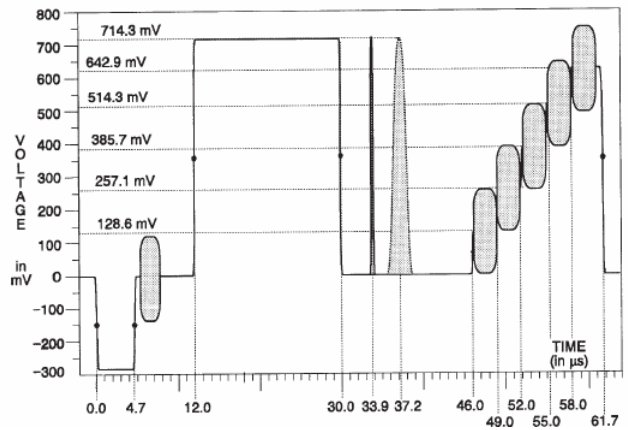
(c)NTC-7 Composite Test Signal
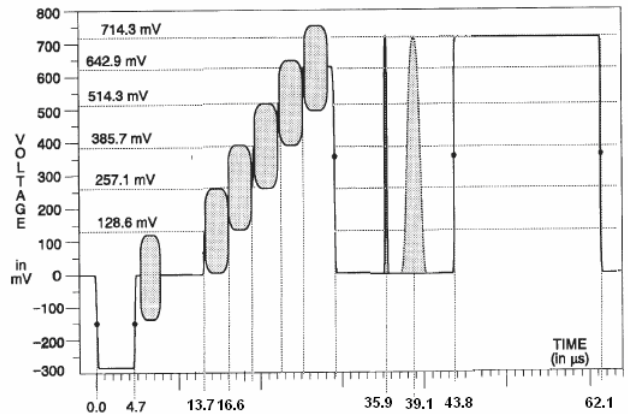
(d) FCC Composite Test Signal

Figure 5.31 CLDI Testing Signal

5.5.12.Differential Phase/Gain

With option 3, user can measure the Differential Phase/Gain:
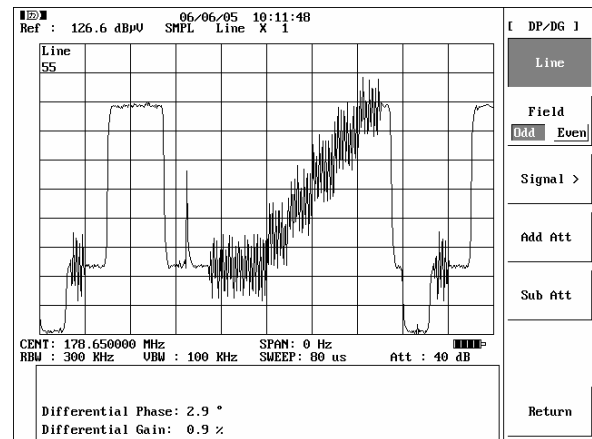
Figure 5.32 Differential Phase/Gain

The differential gain test measures the change in amplitude of the chrominance sub carrier as the luminance changes from a blanking level to a white level. The five-step riser portion of the composite test signal is used to perform this measurement.

The differential phase test measures the change in phase of the chrominance sub carrier as the luminance changes from a blanking level to a white level. It uses the same test signals with differential gain. In PAL standard, CCIR Line

330 and UK ITS 1 are recommended, while in NTSC standard, the FCC Composite Test Signal and the NTC-7 Composite Signal can be used.
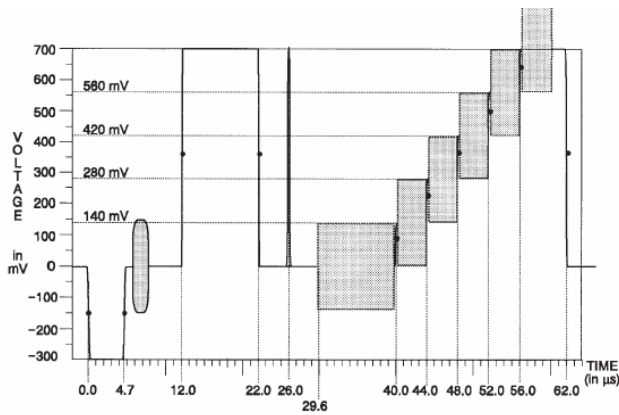
Figure 5.33 Matrix Signal - CCIR Line 330

5.5.13.In-Channel Response

In-channel frequency response measures the baseband frequency response of the channel under test. There are two ways to measure the in-channel response: use a sweep signal or insert a test signal (it needs the option 3):
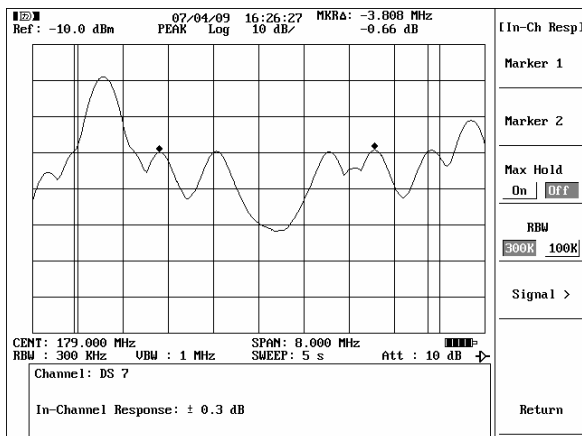
Figure 5.34 In-Channel Response: Sweep Signal
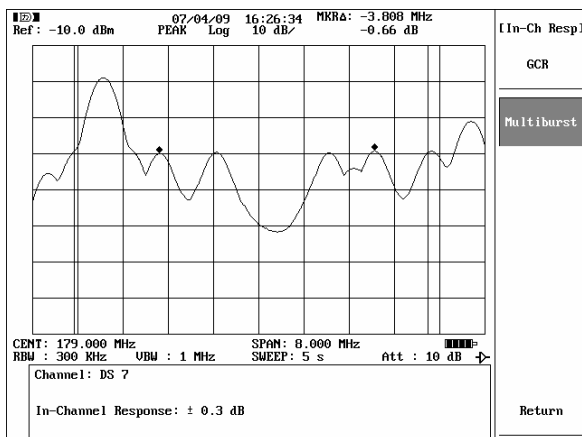
Figure 5.35 Signal Selection

Single line VITS Testing requires one of the following test signals in the vertical blanking interval.

The ghost canceling reference signal is the preferred test signal since it has the most signal level and provide a swept frequency reference over the range of interest for measurement.

The FCC Multiburst Test Signal is more common but only provides frequency response data at discrete frequencies. Note that the 0.5MHz burst packet can't be resolved in a resolution bandwidth of 300KHz. However, 300KHz is the minimum bandwidth required for the analyzer to accurately measure burst packets greater than 4.25us. If all the burst packets were the same time duration, a resolution bandwidth of 100 kHz could be used. The burst height would not be accurate but they all have the same relative amplitude.

The NTC-7 combination signal is the least ideal. It would be useful for relative measurements. The frequency burst's lengths are not equal and too short in duration for the 300 kHz resolution bandwidth to capture them accurately. Some modified NTC-7 combination test signals have near equal pulse widths and are more suitable for this test.

When we press "Signal" soft-key to choose signal mode, we call both FCC Multiburst Test Signal and NTC-7 combination signal as "Multiburst". According to the settings of signal mode, system will automatically search the suitable positions of "Marker 1" and "Marker 2". The positions of "Marker 1" and "Marker 2" can be set manually too. The In-Channel Response testing result that display on the bottom of the screen is calculated by the level difference of these two markers.
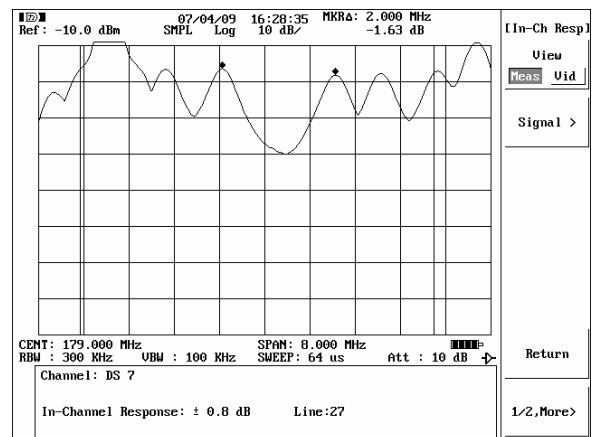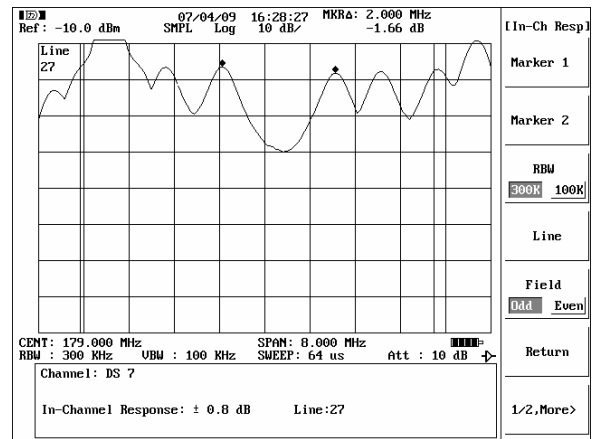
Figure 5.36 In-Channel Response: Insert Test Signal
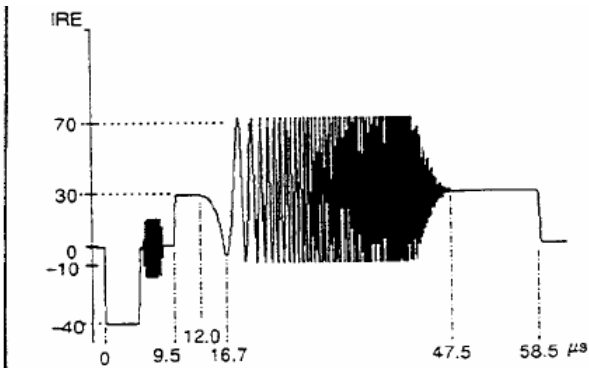
(a) Ghost Canceling Reference Signal

(b) FCC Multiburst Test Signal

(c) NTC-7 Combination Signal

Figure 5.37 Vertical Interval Test Signal

5.6.Channel Scan

Besides measure a single channel, user can also get the information of multi CATV channels by pressing "Scan Chan" soft-key in the CATV root menu.

In the submenu of "Scan Chan", user can choose to scan the "Standard Channel", "User Channel" or "Favourite Channel". And you can set the limit level by pressing "LVL Limit" line. The channel which carrier level is lower than the limit level will be omitted during the channel scan.

Figure 5.38 Channel Scan Root Menu

5.6.1. Standard Channel

Standard channel scan will scan all channels in the channel table include analog and digital channels. To analog channel the amplitudes of the carrier and the first sound are measured, when "Count" is set to "On" the frequency of them is counted. While to the digital channel, only the channel power is measured. Press the "Measure" soft-key in the submenu of "Standard Channel". The test result will be shown on the screen as a histogram. A white line will display on the screen while scan the channels. Running the knob can change the position of the white line. The channel No., visual frequency, visual carrier amplitude and the amplitude difference between visual and aural carrier corresponding to the white line will display on the screen.

Setting "Ref Line" status to "On", the minimum visual carrier amplitude, the difference of maximum and minimum amplitude of visual carrier, the maximum and the minimum visual-to-aural ratio will display on the information window.
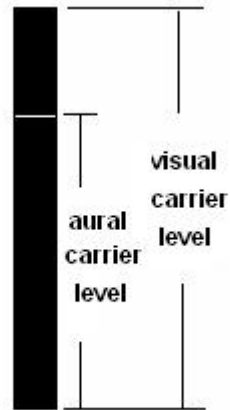
Figure 5.39 Histogram Information
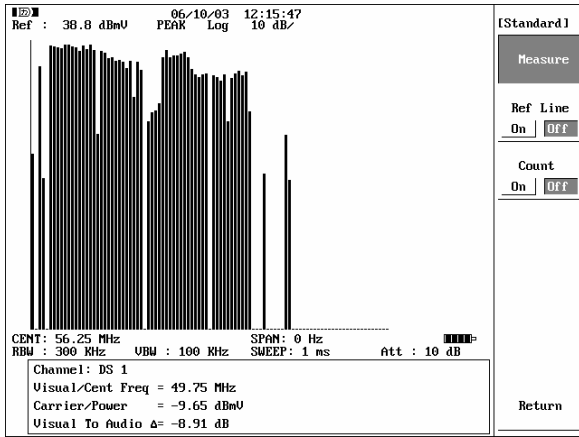
Figure 5.40 Standard Channel Scan
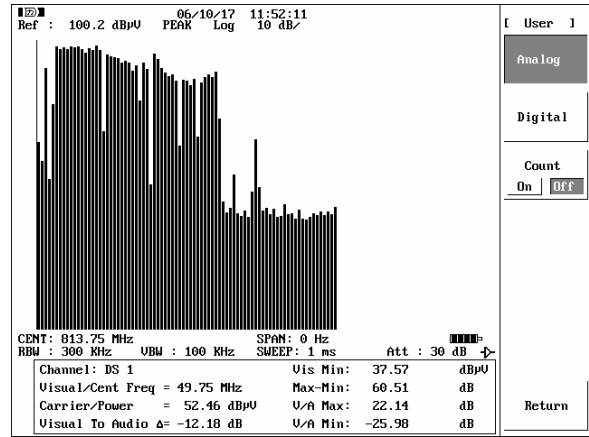
Figure 5.43 Analog Channel Scan Result
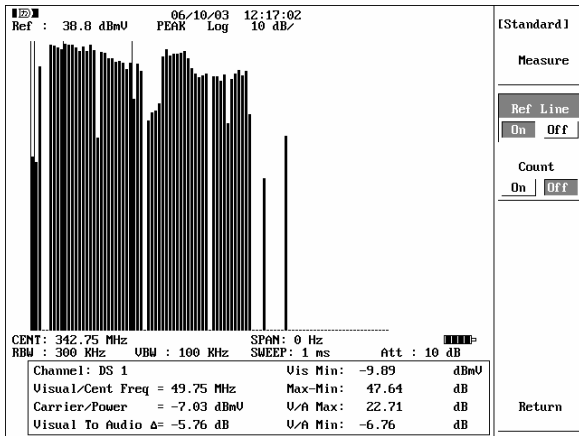
Figure 5.41 Reference Line
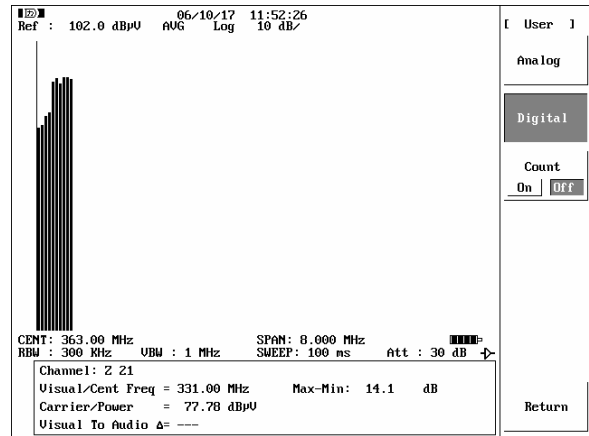
Figure 5.44 Digital Channel Scan Result

5.6.2. User Channel

Select "User Channel" in the Channel Scan Root Menu (Figure 5.37). In the user channel scan mode, user select to scan the "Analog" or "Digital" channels separately. The "Count" can be enabled in analog channel scan.
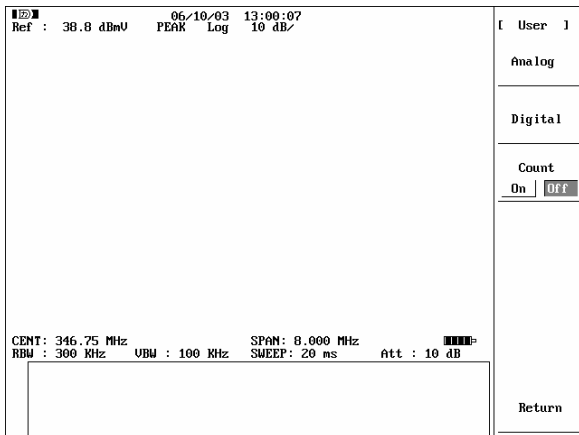
Figure 5.42 User Channel Scan Menu

5.6.3. Favorite Channel

Favorite channel scan enables user to measure 8 channels at a time:
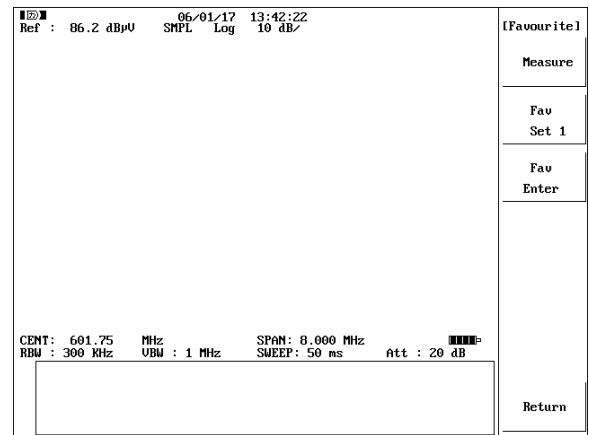
Figure 5.45 Favorite Channel

Create a favorite channel should first press "Fav Set n" to select a channel pointer from 1 to 8, and input the channel number/frequency. After inputting the value, press "Fav Enter" to confirm.

Note：

Favorite channel can be settled by inputting the frequency. But the frequency must be included in the standard table. Otherwise it will be automatically changed to the nearest frequency that is included in the standard table.
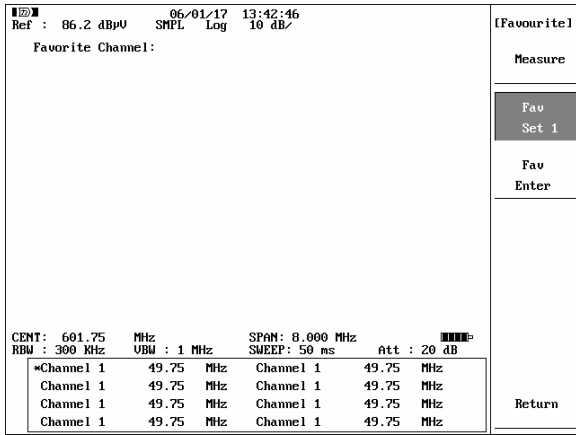
Figure 5.46 Create Favorite Channel

Press "Measure" to measure the favorite channel:
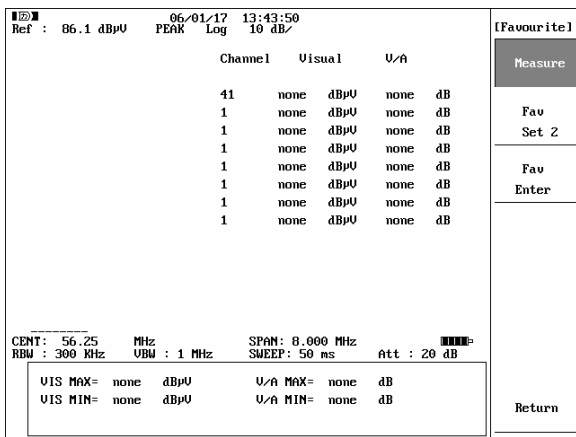
Figure 5.47 Favorite Channel Scan

5.7.FCC Report

By pressing the "Sys Meas" soft-key in the CATV root menu, User can enter the FCC menu. In this menu, the information about the FCC report will display on the screen.
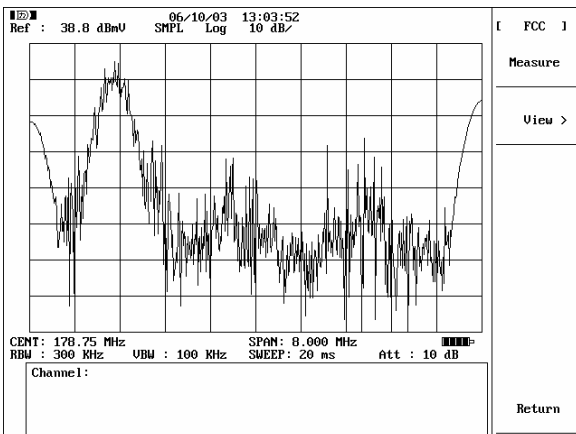
Figure 5.48 FCC menu

Press "Measure" softkey, then the analyzer will automatically test the system according to the settings that defined in TV Plan. Every enable items of the enable channels will be measured.

Note：

This test will take a long time if most channels and items are set to "Enable". And the testing process can't be interrupted. So before press this soft-key please check the TV plan firstly to make sure that all the enable channels and items are what you want to test.

After measure, the FCC report will be store on the DOC (Disk-On-Chips). The file name is defined by the two posterior number of year (such as 06) + month (such as 03) + date (such as 15) + file number. The file number is from 00 to 99. It is said that in one day the DOC mostly can save 100 FCC reports.

"View": View the existed FCC report. As Figure 5.48 shows, there are three reports we can get. Run the knob to select the report. Press "View" to see the detail of FCC report. The basic information is displayed in the first page of the FCC report which is shown as Figure 5.49(a). The followed are the analog channel testing results. Five results of analog channels can be displayed in one page. The digital channel testing results will display on the last page. There are mostly 15 digital test results can display on the screen. In the report, "--" means the "Gate" is set to "On", but the analyzer can't successfully trig the line. The blank corresponds to the "Disable" testing items.

"Delete": Delete the selected report.

"Upload": Upload the selected report to the USB disk or the PC.
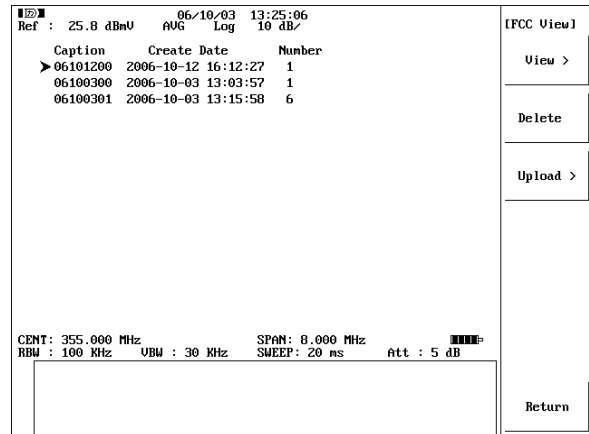
Figure 5.49 FCC View Menu

(a)

```
|▌|⊠|▋|                06/10/03  13:25:28              [ View ]
Ref :  25.8 dBmV     AVG     Log    10 dB/
```
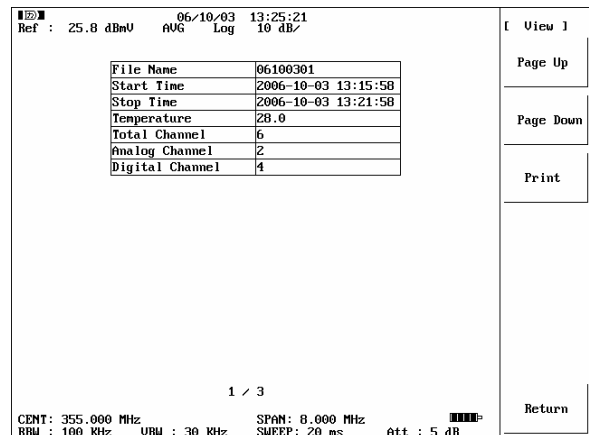
	1	107			
Carr Lev *	-4.62	37.70			
Carr Freq Hz	49748079	160249569			
Snd1 Lev dB	-11.48	17.00			
Snd1 Freq Hz	6497342	6499981			
Snd2 Lev dB					
Snd2 Freq Hz					
FM Dev KHz	29	29			
Depth Mod %	---	87			
CCN dB	2.6	43.6			
Hum %	41.3	6.6			
Cross dB	43.4	22.5			
CTB Lev *	---	4.0			
CTB Freq Hz	---	0			
CSO Lev: *	---	44.5			
CSO Freq Hz	---	-1248000			
CLDI nS	---	1399			
DG %	---	75			
DP °	---	30			
Resp dB	1.5	-1.9			

```
*:dBmV                      2 / 3

CENT: 355.000 MHz              SPAN: 8.000 MHz     ◼◼◼◼▷
RBW : 100 KHz    VBW : 30 KHz   SWEEP: 20 ms    Att : 5 dB
```

View buttons: Page Up, Page Down, Print, Return

(b)

```
|▌|⊠|▋|                06/10/03  13:28:07              [ View ]
Ref :  25.8 dBmV     AVG     Log    10 dB/
```

	121	122	123	124	
Chan Power *	17.3	18.9	21.3	23.4	
BER-Pre	1.0 E -9	1.0 E -9	1.0 E -9	1.0 E -9	
BER-Post	1.0 E -9	1.0 E -9	1.0 E -9	1.0 E -9	
MER dB	30.2	30.5	30.8	33.2	
EVM %	2.0	2.0	1.9	1.5	
Chan Power *					
BER-Pre					
BER-Post					
MER dB					
EVM %					
Chan Power *					
BER-Pre					
BER-Post					
MER dB					
EVM %					

```
*:dBmV                      3 / 3

CENT: 355.000 MHz              SPAN: 8.000 MHz     ◼◼◼◼▷
RBW : 100 KHz    VBW : 30 KHz   SWEEP: 20 ms    Att : 5 dB
```

View buttons: Page Up, Page Down, Print, Return

(c)

Figure 5.50 The Contents of the FCC Report

6. Digital TV (Option 4)

Main Points of This Chapter：

● **Constellation diagram**

● **Statistical Graph Display**

● **Equalizer display**

● **Reference settings**

6.1.Summarize

The instrument can measure the main specs of digital signal such as display constellation diagram, BER, MER/EVM, etc. After pressing **MODE** key on the front panel and select "DTV Analyzer" soft-key, the submenu of it will appear which is shown as (a) of figure 6.1. By pressing "1/2 More>" soft-key, User can enter the next menu of digital TV which is shown as (b) of figure 6.1.
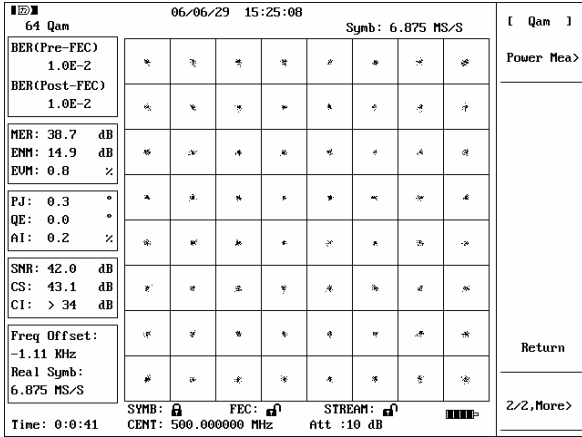
(a) First Page
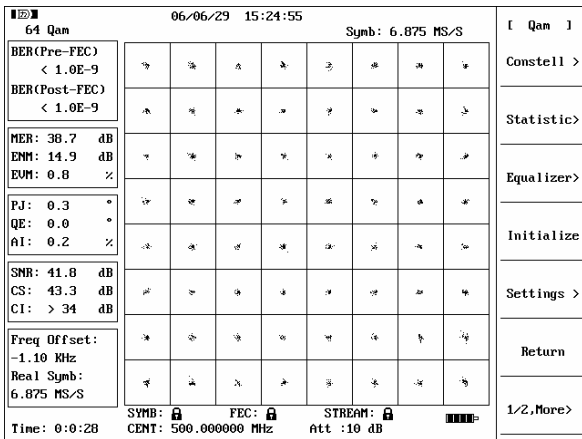
(b) Second Page

Figure 6.1 Digital TV Menu

"Constell": User can change the constellation diagram display state in the submenu of this soft-key, such as **Zoom In**, **Zoom Out** and **Display Mode** etc.

"Statistic" Put out the statistic results of MER，BER (Pre-FEC) and BER (Post-FEC).

"Equalizer": Put out the coefficient of the equalizer. In the submenu of this key User can choose the equalizer mode.

"Initialize": Reset all auto adjusted parameters and then adjust them again. In the initialization period, the demodulation system will diagnose the signal automatically to access the symbol and frequency offset. According to these offset information the system will adjust the demodulation process and system coefficient to match the signal. So if the changes of signal cause the system unable to demodulate correctly, user can press "Initialize" soft-key to initial the demodulation. Generally speaking, if the symbol rate offset is less than 50KS/S and frequency offset is less than 100KHZ, the demodulation system can successfully adjust itself to match the signal.

"Settings": User can set the parameters such as center frequency, symbol rate, standard type etc in the submenu of this soft-key.

"**Power Mea>":** Provide a directly way change from QAM analyzer to channel power measurement.

"**Parameter>":** Provide constellation diagram analysis and display some parameters for analysis result. This function is still under development.

The instrument displays the measurement results on the left of the screen, including Bit Error Rate(BER (Pre_Fec), BER (Post – Fec)), Modulation Error Ratio (MER), Estimate Noise Margin(ENM) , Error Vector Magnitude(EVM) ,Phase Jitter(PJ),Quadrate Error(QE), Amplitude Imbalance(AI), Frequency offset (Freq Offset) and Real Symbol Rate(Real Symb).

At the bottom of screen, THE INSTRUMENT shows the lock status of symbol (SYBM), forward error correction (FEC), and stream (STREAM).

6.2.Constellation Diagram

Press the "Constell" soft-key, the submenu of it will appear:
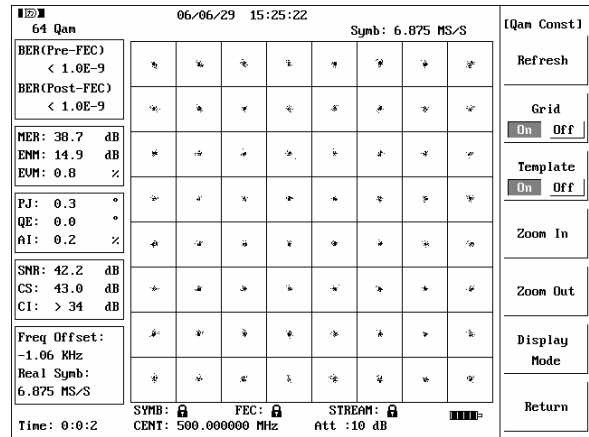
Figure 6.2 Constellation Menu

"Refresh": Clear the screen and reset the point counter.

"Grid": Control the "On/Off" state of the grid that display on the constellation diagram.

"Template": Control the "On/Off" state of the template that displays on the constellation diagram.

"Zoom In" and "Zoom Out": Zoom in/out the signed area (in the blue frame) that can be selected by turning the knob or pressing the array keys.
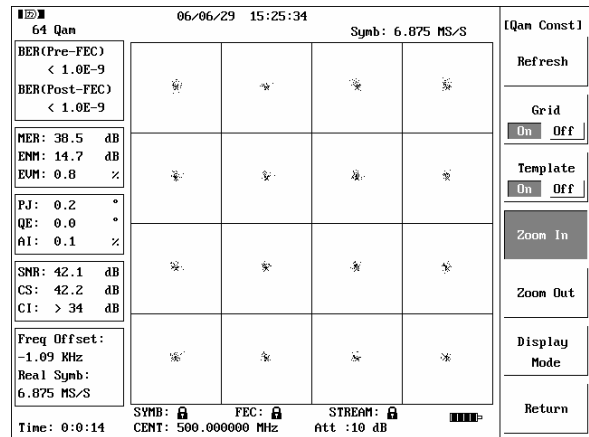
Figure 6.3 Constellation of 64QAM after Zoom In

"**Display Mode":** After pressing this soft-key, the submenu of it which is shown as Figure 6.4.There are three modes user can choose in this submenu:

"Continuous": In this mode, the Instrument continuously plot new symbols on the screen and do not clear old symbols until the "**Refresh**" soft-key in the figure 6.2 is pressed or display mod is set again. There is no limit to the number of symbols that are displayed in this mode.

"Cyclic": In this mode, the Instrument plot the number of symbols specified in the sample length on the screen and then clear them all and start again.

"Time Filter": In this mode, the Instrument plots the number of symbols specified in the sample length and then uses a first in/first out (FIFO) function to clear the oldest symbols and plot new symbols. The number of symbols displayed on screen is always the same.

If user chooses the **Cyclic** or the **Time Filter** mode, User can enter the sample length, for example 8000 (the default value).
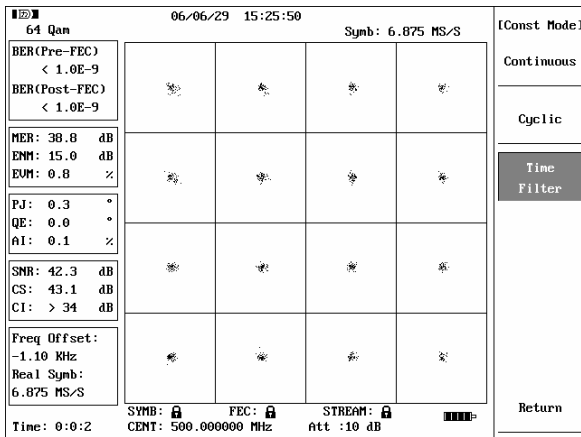
Figure 6.4 Display Mode

6.3. Statistic Graph

Press "**Statistic**" soft-key, the submenu of this key will appear which is shown as figure 6.5.
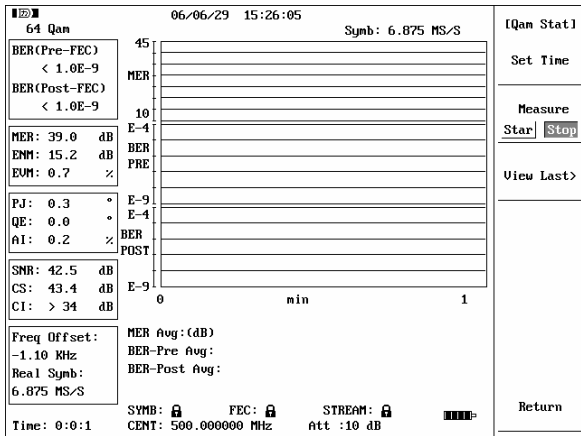
Figure 6.5 Statistic Graph

The statistic graph provides the statistic graph of MER, BER (Pre-FEC) and BER (Post-FEC) in a specified period. At the bottom of the statistic graph, the instrument put out the average values of these statistic indexes.

"Set Time": After pressing this soft-key, user can enter a period of time by inputting the number directly, turning the knob or pressing the array key. The statistic period can be set from 1 to 4320 minutes.

"Measure": After setting time, press "Measure" soft-key and choose "Start/Stop" of it, then the measure will go as user's wish.

"View last": After at least one entire measurement, User can choose this soft-key to view the last measure result. If user never finished a measurement, the instrument will show the notice "Half-baked Data", else user will enter the submenu of it, which is shown as figure 6.6. In this menu user can choose "View All" no matter how long the statistic period is. But the other 4 soft-keys only can be activated when the statistic period is more than 400 minutes. User can zoom in the store statistic to see the details of graph, or User can look the graph page by page.
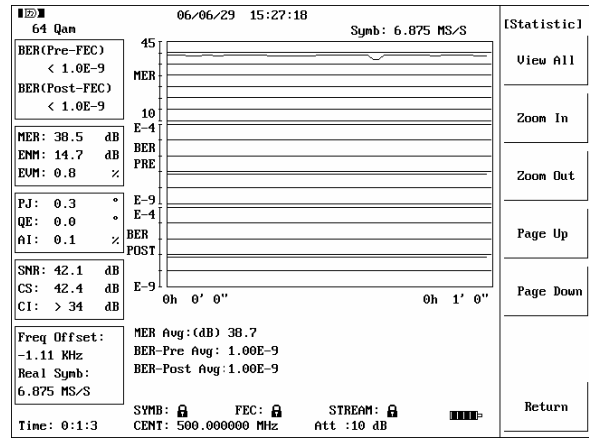
Figure 6.6 Statistic View Menu

6.4. Equalizer Display

Press the "Equalizer" soft-key, the submenu of this key will appear which is as shown in figure 6.7.
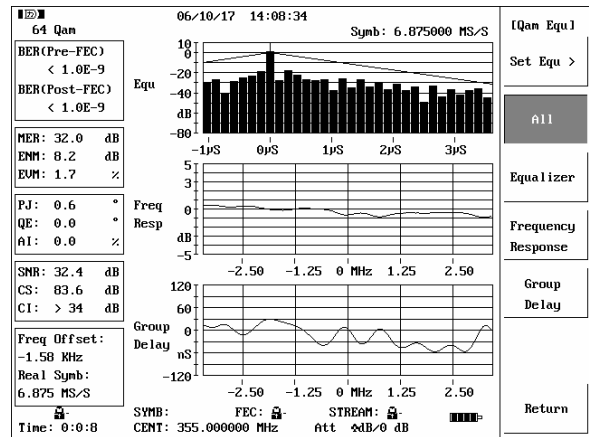
Figure 6.7 Equalizer Display

There are three different messages display in the equalizer screen.

1. The output of the Equalizer coefficients. This feature can be used to diagnose channel distortion (gain tilt, reflections etc). The bar graph showing the 32 coefficients: 8 Feed-Forward Equalizers (FFE) and 24 Decision Feedback Equalizers (DFE). The eighth coefficient is the main signal path, so it is normally very close to 0 dB (unity gain).

2. Frequency response of the tested channel. The amplitude is from -5dB to 5dB.

3. Group delay shows the delay in nsec (from -120 to 120 nsec) across the channel bandwidth.
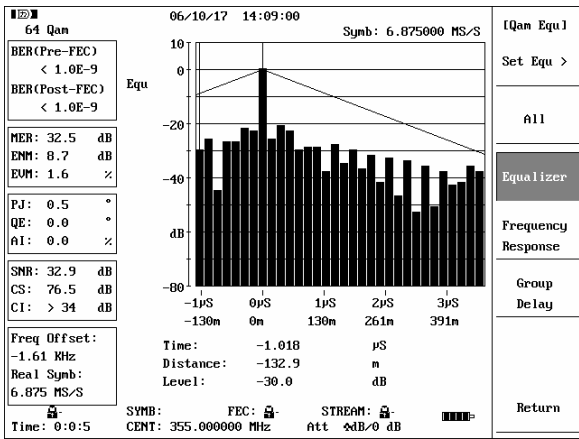
Figure 6.8 Equalizer Coefficient Display

Equalizer Coefficient Display

Press "Equalizer" soft-key, then the equalizer coefficient will independently display on the screen which is shown as Figure 6.8. The level, distance and time values corresponding to the white indicatrix will display on the screen too.

Frequency Response Display

Independently display the frequency response by pressing "Frequency Response" soft-key. In this mode, vertical and horizontal markers are available to perform specific measurements.

In Figure 6.9, the maximum, minimum values, the difference of them and current values are displayed on the screen.
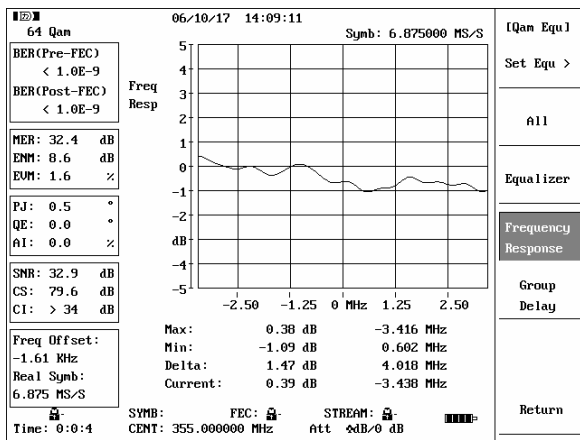
Figure 6.9 Frequency Response Display

Group Delay Display:

The group delay response can be viewed independently from within the Equalizer Display by pressing "Group Delay" soft-key. The maximum, minimum values, the difference of them and current values are displayed on the screen
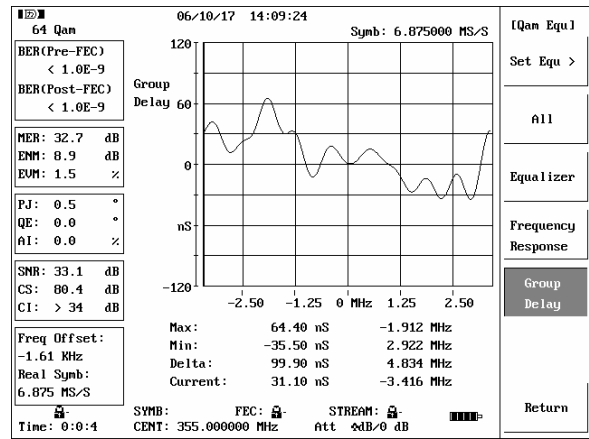
Figure 6.10 Group Delay Display

6.5.Settings

After pressing the "**settings**" soft-key, the submenu of this key will appear which is shown as figure 6.11 (a). By pressing "1/2, More>", user can enter the next page of settings menu.
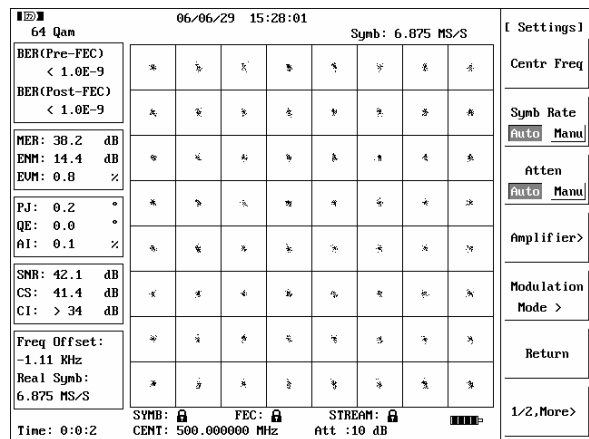
(a)   First Page
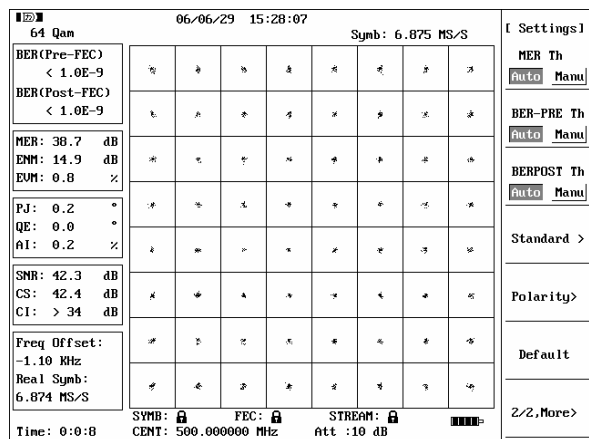
(b)   Second Page

Figure 6.11 Parameter Settings

In this menu, User can set every adjustable parameter, such as the center frequency, symbol rate, attenuator etc.

"Centr Freq": Set the center frequency. Also user can press FREQUENCY on the front panel, which can also input a channel number in a standard channel table.

"Symbol Rate": It can be set automatically or set to a special value by changing the "Symb Rate" to "Manu".

"Atten": Set the attenuator to "Auto" or "Manu". In auto

mode the attenuator can be adjusted automatically according to the magnitude of the tested signal. In some cases user need to adjust the attenuator manually. The better way to access the befitting value of the attenuator is to change the screen to the channel power measurement by pressing the "Power Mea>" soft-key in figure 6.1(b). In that screen, adjust attenuator to access the best SNR in conditions of no signal distortion and write down the corresponding attenuator value. Turn back to the digital TV measure mode and adjust the attenuator to the signed value, then user can get the best constellation output.

Note:

In some special conditions (For example: in CATV measurement when the carrier level difference of different channels is more than 15 dB), the auto-adjusted attenuator may not fulfill the measurement, in such conditions user need to adjust attenuator manually. Add or subtract the attenuator value and view the constellation whether it is improved or not. Until user get the satisfied output.

"Amplifier": Press this soft-key, User can enter the submenu of it and set the state of the pre-amplifier of the instrument. The default state of amplifier is auto.
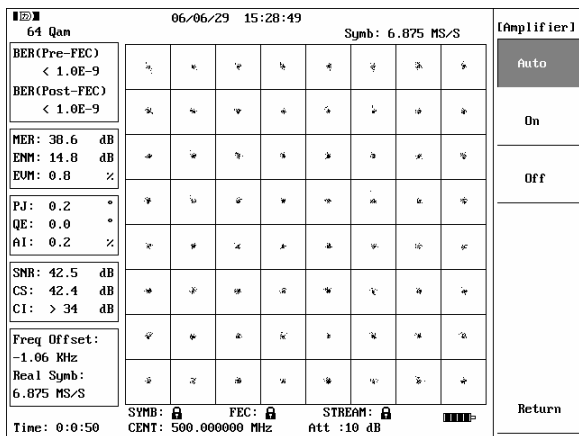
Figure 6.12 Amplifier Submenu

"Qam Select": The instrument supports QPSK, 16QAM, 32 QAM, 64 QAM, 128 QAM, and 256 QAM. User can make a choice in the submenu of "QAM Select" which is shown as figure 6.13.
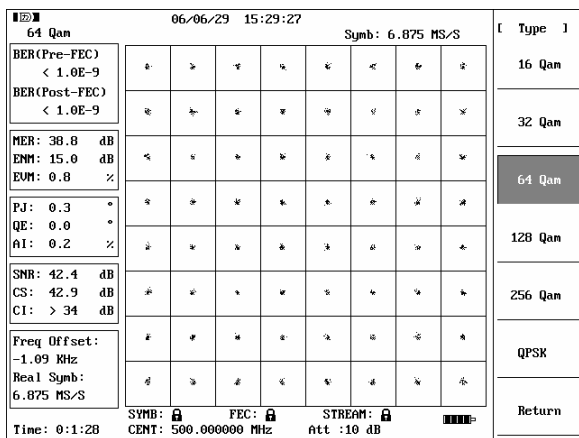
Figure 6.13 Modulation Mode

"MER Th": Press this soft-key to set the threshold of MER which range is from 10 to 40dB.The default value is 23.5dB.

"BER-PRE Th": Press this soft-key to set the threshold of BER(Pre-FEC) which range is from 1e-2 to 1e-9.The default value is 1e-5.

"BERPOST Th": Press this soft-key to set the threshold of BER (Post-FEC) which range is from 1e-2 to 1e-9.The default value is 1e-8.

Note:

User can change these thresholds according to user requirement. When the measure result become lower than the corresponding threshold, the color of the result will be changed for arresting the user's attention.

"Standard": Presses this soft-key, user can choose different standards in its' submenu. The instrument supports J83.ANNEX A, J83.ANNEX B, J83.ANNEX C, Reverse and NO FEC Decoding. (See Figure 6.14)
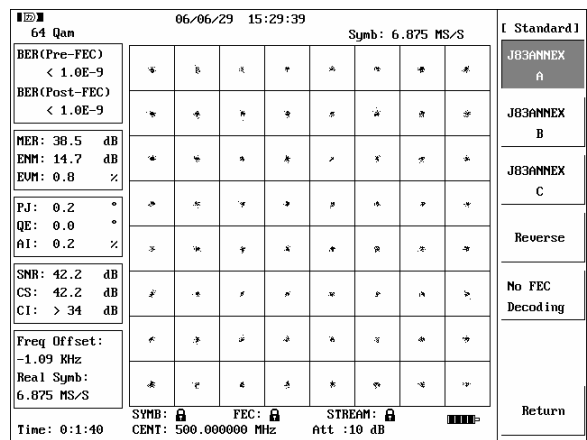
Figure 6.14 Standard

"Polarity": Presses this soft-key, user can enter the submenu to set the polarity of the signal, such as Auto, Normal and Reverse. But if user's manual setting of the polarity is not in accordance with the real state of input signal, the analyzer may be unable to decode the signal. The default state of system is "auto". (See Figure 6.15)
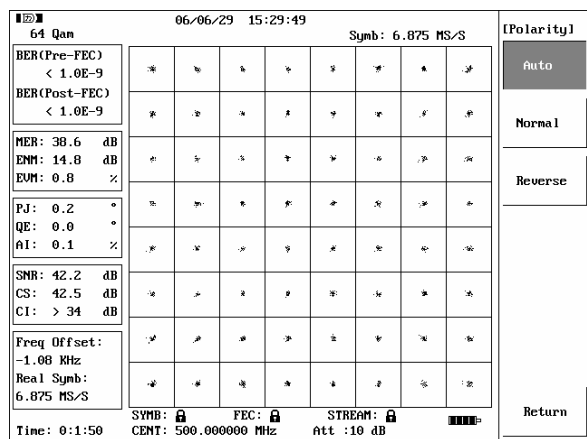
Figure 6.15 Polarity Menu

"Default": Press this soft-key, all the manual settings in DVB mode will be changed to the default values. As the default conditions, in standard J83.ANNEX-A the symbol rate of QPSK, 16QAM, 32QAM, 64QAM and 128QAM is 6.875MS/S, and it is 6.952MS/S while 256QAM; in standard J83.ANNEX-B the symbol rate of QPSK, 16QAM, 32QAM, 64QAM and 128QAM is 5.057MS/S, and it is 5.361MS/S while 256QAM; in standard J83.ANNEX-C the

symbol rate of QPSK, 16QAM, 32QAM, 64QAM and 128QAM is 5.274MS/S, and it is 5.361MS/S while 256QAM.

7. Tracking Generator and HFC Analyzer

Main points of this Chapter：

● **Tracking Generator (Option 5)**

7.1.Tracking generator

Press "Tracking" soft-key in the mode menu, and then the submenu which is shown as figure 7.1 will appear on the screen.
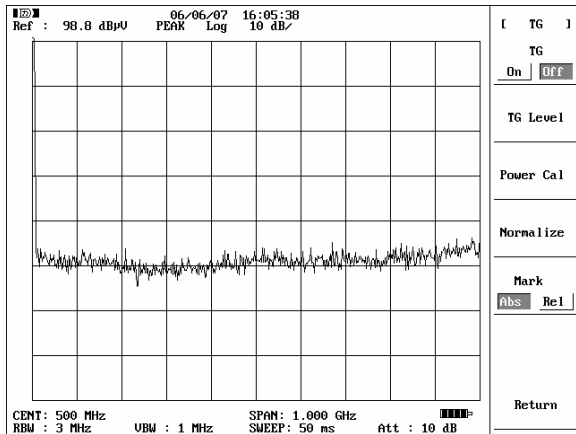
Figure 7.1 Tracking Generator menu

To use the tracking generator, firstly we should connect the generator and the analyzer well. The connection diagram is shown as the figure 7.2
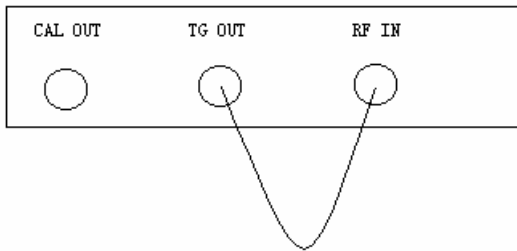
Figure 7.2 TG connection diagram

After connecting the TG well, set the "TG" status to "On", then the screen that is shown as figure 7.3 will display on the screen.

The level range of the tracking generator is from 0dBm (108.8 dBμV) to -60dBm (48.8 dBμV). The default output level is 88.8 dBμV when the first time TG was set to be on. After pressing "TG level" soft-key, by running the knob, pressing the Up/Down key or directly inputting the number can change the output level of the TG.

But if it is the first time to use TG or the testing environment has been changed, it is recommended to do a power calibration firstly before using it to test devices.

The calibrating step is firstly to connect the TG OUT to the RF IN with a standard BNC cable (It would be better to use the accessory cable), and then press the "Power Cal" soft-key. The TG will be automatically calibrated from 0dBm to -60dBm. This calibration probably needs several minutes. And you'd better not power off the analyzer when it shows "Calibrating" on the screen. If the TG cannot fulfill the requirement that the level flatness in all frequency range is less than 1dB, the system will give the prompt "Calibrate Failed". The calibration data will not be lost with the power off of the analyzer.
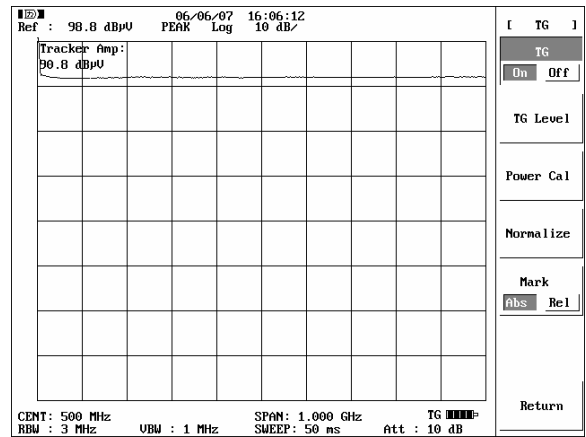
Figure 7.3 Tracking on

Perform "Normalize" operation, should connect the TG OUT straight to RF IN too. It is different from power calibration. The actual output of TG will not be changed. After pressing this key, the output line is corrected to a beeline. The difference between this beeline and its pre-curve is memorized. And correction data will be used in the future testing. But when frequency, reference level, attenuator or output level is changed, the correction data will be lost and user should normalize it again. Also it will be lost with the power off of the analyzer.

When the unit of reference level is dBm, dBmV or dBμV, by pressing the "Mark" soft-key and changing the status of it, the test result of the marker(s) displayed on the information window can be the absolute value or the relative value to the TG ideal output level. From the figure 7.4 we can clearly view the difference between these two display mode.
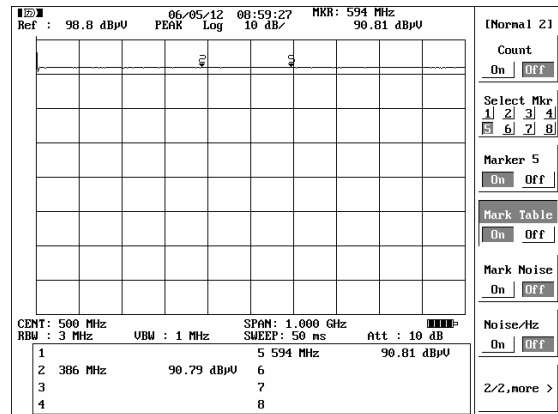
（a）Absolute Value Display
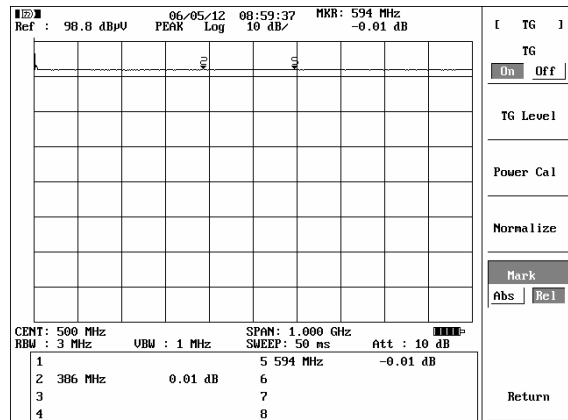
（b）Relative Value Display

Figure 7.4 Two Marker Display Mode

Here is an instance to use the TG to measure a filter.

1. Press the "CAL" on the front-panel and select "Calibrate Amplitude" soft-key to do an analyzer calibration.

2. Turn on the TG, and connect the TG OUT to RF IN, which is shown as figure 7.2.

3. Do a TG power calibration and then press "Normalize" soft-key.

4. Connect the TG OUT, tested component and RF IN well as figure 7.5 shows.

5. The testing result will be displayed on the screen.
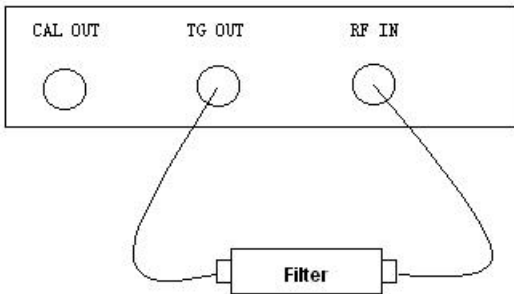
Figure 7.5 Tested Component Connection diagram
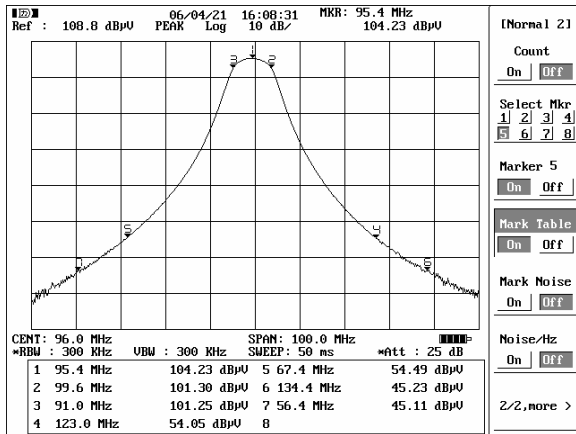
Figure 7.6 Testing result

8. Other Functions and Settings

main points of this chapter:

● **System calibration**

● **System config**

● **Picture saving**

● **Software update**

8-1
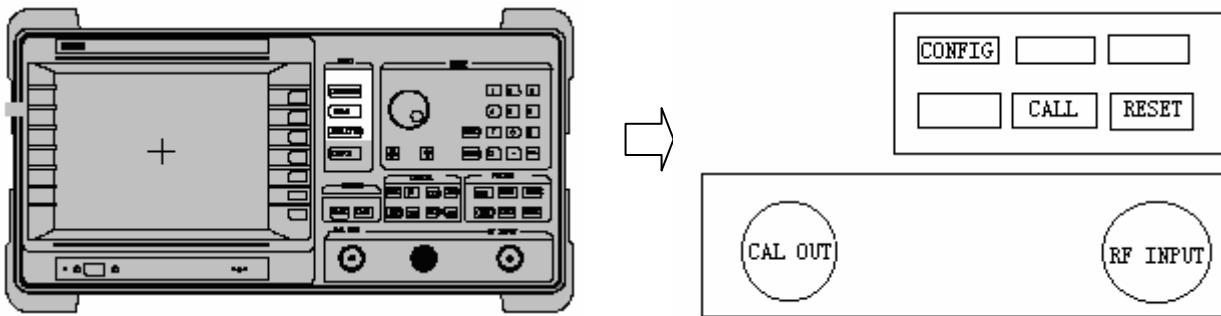
8.1. System Calibration

For the analyzer to meet its specifications and characteristics the self-calibration routines should be performed periodically or whenever the ambient temperature changes.

System calibration includes frequency calibration and amplitude calibration. Frequency calibration is to rectify the frequency error caused by IF filter. Amplitude calibration is to rectify the amplitude error, which can be caused by window functions of different RBW or attenuators, so Amplitude calibration should be taken with different RBW or attenuators.

Allow the analyzer to warm up for 30 minutes before performing the following calibration steps:

Connect the "CAL OUT" and "RF INPUT" on the front panel by the BNC-BNC cable.

Caution：

Make sure that the used BNC-BNC cable is the fitting of the instrument.

Press the "CAL" key on the front-panel, the submenu of it will appear which is shown as figure 8.1.
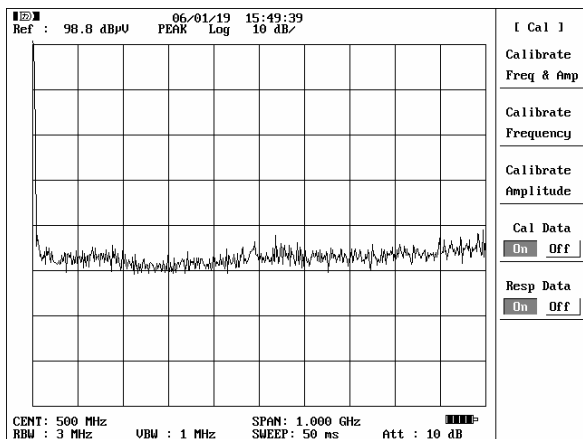
Figure 8.1 Calibration Menu

"Cal Freq and Amp": Calibrate both amplitude and frequency.

"Cal Frequency": Calibrate the frequency.

"Cal Amplitude": Calibrate the amplitude.

Note ：

During the process of calibration, the instrument is unable to response to the keyboard commands except the "RESET" key.

"Cal Data": Choose to add the calibration data to the spectrum display or not.

"Resp Data": Choose to add the frequency response data to the spectrum display or not. The response data is set before the instrument leave factory and unable to be changed.

8.2. System config
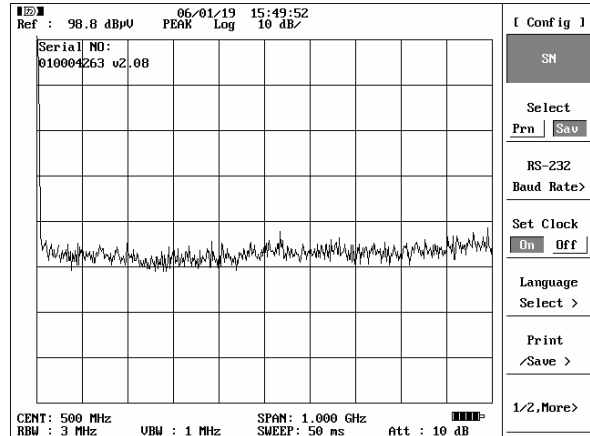
(a)   First Page

Press the "CONFIG" key on the front-panel，then you can configure the system. Figure 8.2 shows the submenu of this key.
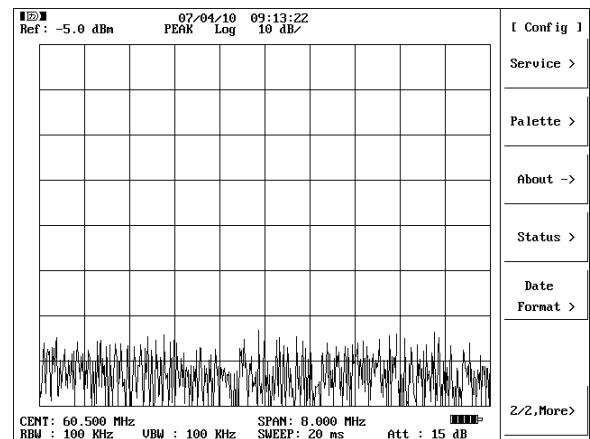
(b)   Second Page

Figure 8.2 Config Menu

8.2.1. Serial No.

Serial number is an important symbol of this instrument and it is very useful for the maintenance. Press the "SN " soft-key, the serial No. will be displayed on the up-left corner of the screen, which is shown as the figure 8.2 (a).

8.2.2. Print/Save diplex key

There is a "PRINT/SAVE" diplex key on the front-panel. Two soft-keys "Select Prn/Sav" and "Print/Save" in figure 8.2 are defined to cooperate with this diplex key.

"Select" soft-key defines the current state of "PRINT/SAVE" key. When it is set to "Prn", after pressing "PRINT/SAVE" key, the picture that is being displayed on the screen will be printed out. If the printer isn't prepared well, an error message "#37: Not connected" will display on the screen. When "Sav" state is selected, after pressing "PRINT/SAVE" key, system will give the prompt "#41: Input a Name: Enter to continue". After input the file name, press "ENTER" key on the front panel, then the picture that is being displayed on the screen will be saved.

"Print/Save" soft-key is used to do the extend operations of "PRINT/SAVE" key. Pressing this soft-key, the submenu which is shown as figure 8.3 will appear on the screen.
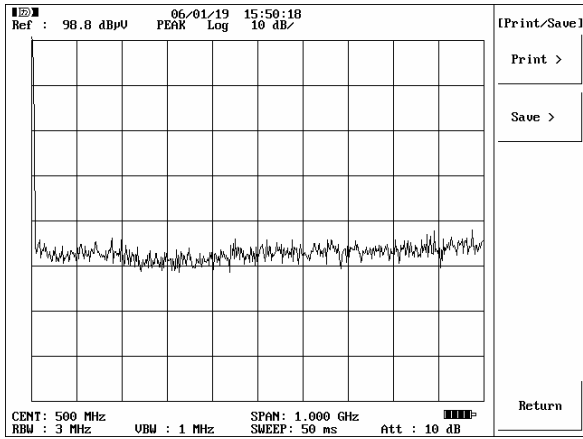
Figure 8.3 Print/Save Menu

"Print": User can choose the printer type in the submenu of this soft-key (see figure 8.4).

"Save": This soft-key is used to manage the pictures that user has been saved. The submenu of this soft-key is shown as figure 8.5.
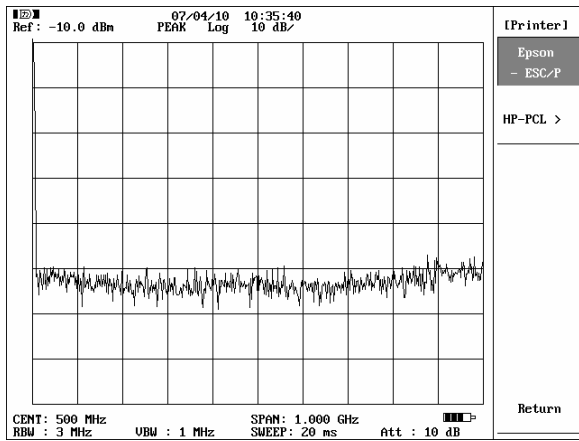
Figure 8.4 Printer Menu
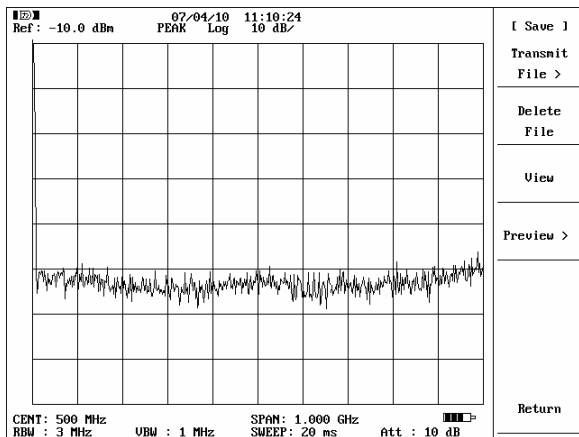
Figure 8.5 Save Menu

"Transmit File": Transmit the signed pictures to the PC or flash disk. After pressing this soft-key, in the submenu of it you can choose to send the picture to PC through "RS-232" or to "USB Disk" (see figure 8.6).

If choose "USB Disk", the USB Disk should be connected well before starting the instrument.

If "RS-232" is selected, make sure that PC has been connected well to the instrument and then run the "bmp.exe" in the PC which is provided with the instrument. Figure 8.7 is the interface of "bmp.exe". After setting the store path, press "Start". The picture will be transmitted

from the instrument to the PC.

"Delete File": Delete the signed pictures. After pressing this soft-key, the system will give the notice "Really del the file(s)", press "ENTER" key to confirm the deletion.

Before run the "Transmit file" and "Delete file" operation, use should select files firstly by "View" soft-key.
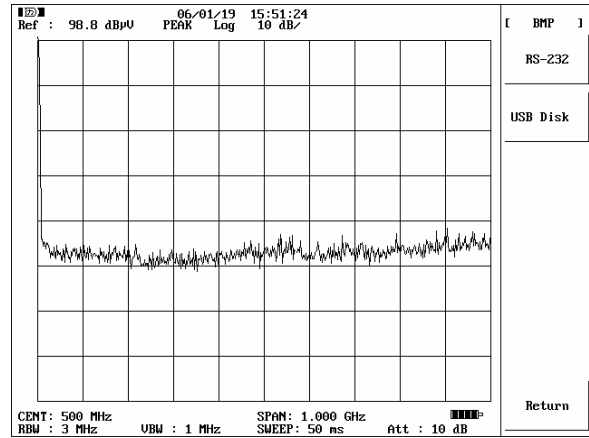
Figure 8.6 Transmit Menu
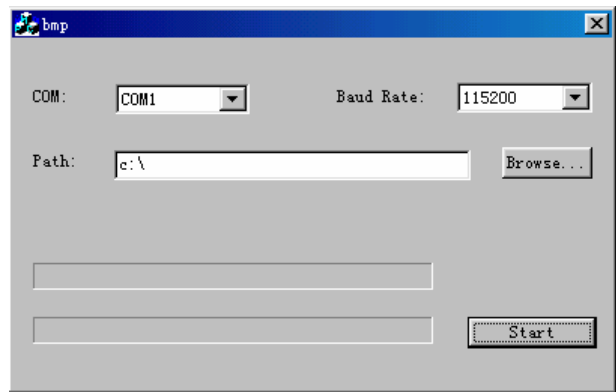
Figure 8.7 Interface of bmp.exe

"View": Press this soft-key to select the pictures you want to deal with. Run the knob and press "ENTER" key to finish the selection, and press "ENTER" key again to release the selection. You can choose one or several pictures in this step.

"Preview": View the saved pictures on the screen page by page. To preview the pictures, you don't need to sign them beforehand. All stored pictures can display on the screen by pressing "Page Up" or "Page Down" soft-key. The related information about the current displayed picture will display on the right side of the screen, such as the file name the saving time and the position of the current picture.
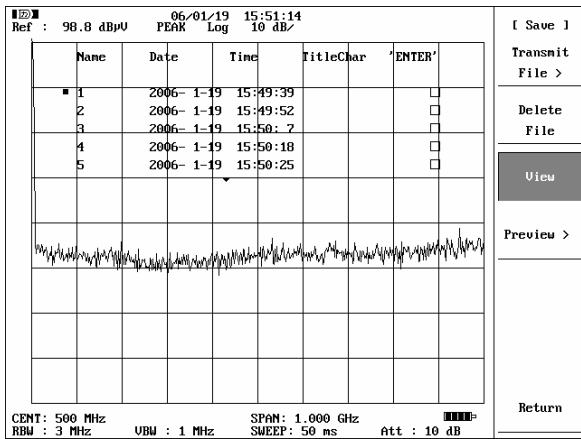
Figure 8.8 View Picture
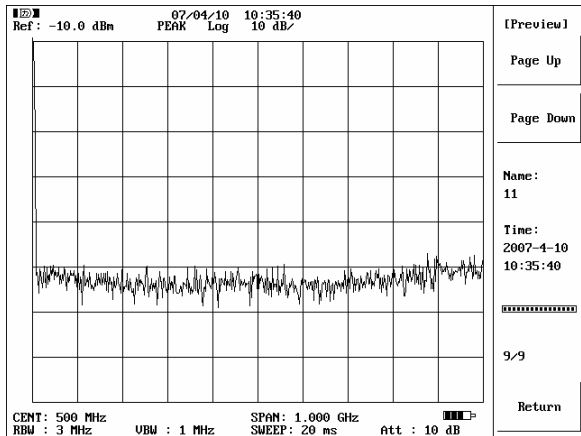
Figure 8.9   Preview Picture

8.2.3. Baud Rate

After pressing "RS-232 Band Rate" soft-key, in the submenu of it which is shown as figure 8.10 you can set the band rate of COM port. The default value is 115200bps, and whenever DS8821 is reset, this default value will be set to COM port.

Note：

The baud rate is set for the transmitting from the instrument to PC, for example send pictures to the PC or receive the update files from the PC. So you should make sure that the PC baud rate is in accordance with the instrument.
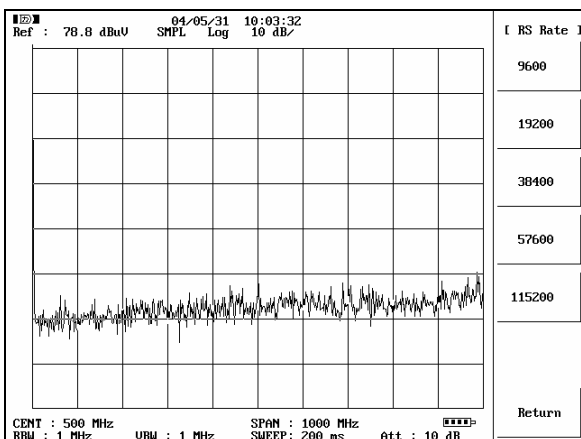
Figure 8.10 Baud Rate Setting Menu

8.2.4. Clock Setting

Press the "Set Clock" soft-key, you can set the "On" or "Off" of the time display. If select "On" state, you can input the local time. The step of clock setting is that firstly input number and then select "Sec", "Minute", "Hour", "Day", "Month" and "Year".

The input format is "2006" "Year", "01" "Month", "02" "Day", "13" "Hour", "04" "Minute", "05" "Sec", and the display format is "06/01/02   13:04:05".(see figure 8.11)
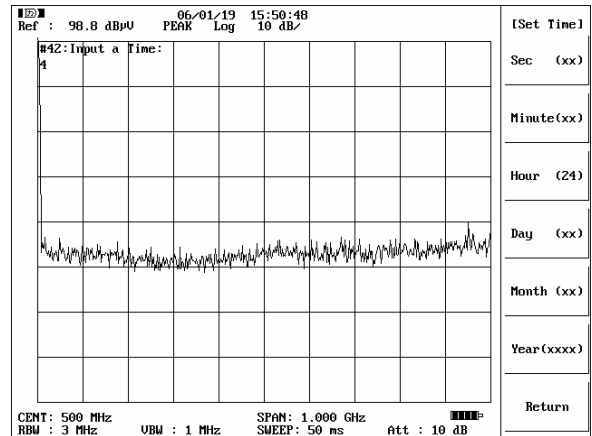
Figure 8.11 Time Setting

8.2.5. Language Select

Press the "Language Select" soft-key, you can choose the language between Chinese and English. The selection will not lose with the power-off of system.

8.2.6. Palette
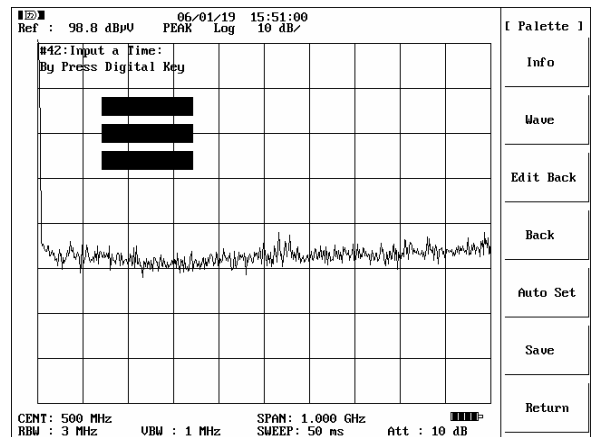
Figure 8.12 Palette Setting
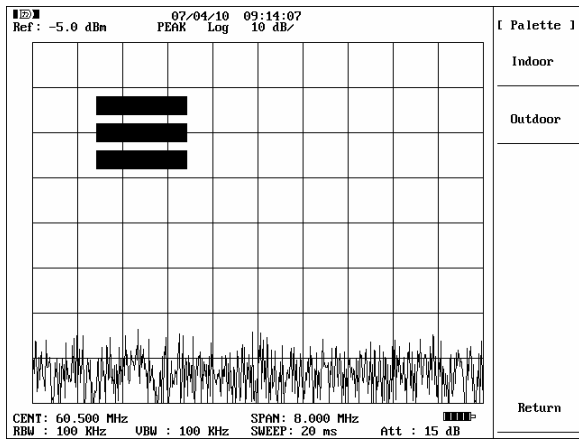
Figure 8.13 System Default Palette

To provide a more comfortable use of different environment, you can change the color of information, wave, edit background or background etc. The change step is firstly to selecting the item you want to change and then turning the knob until gets the color you wanted.

"Auto Set": Return to the system default color settings. There two modes "Indoor" and "Outdoor" can be selected in the submenu of this soft-key.

"Save": save the changed colors.

8.2.7. System Information

Press the "About " soft-key in the second page shown as figure 8.2 (b), then you can view the software version, the firmware version, space information, calibrate information, option information and so on.
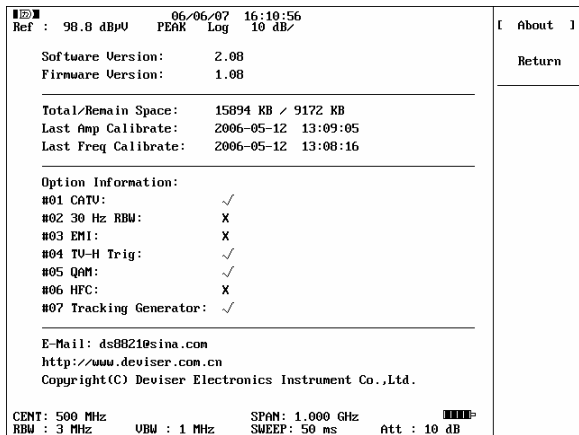
Figure 8.14 About Menu

8.2.8. Status

Press the "Status" menu, then the submenu of it which is shown as figure 8.15 will appear on the screen. In this menu, user can choose to "Save" the current status, "Load" or "Del" an existing status, or "View" all the existing status user have ever saved.
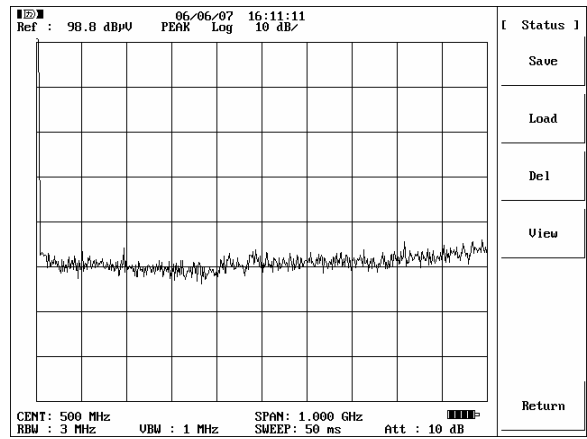
Figure 8.15 Status Menu

8.2.9. Date format

This soft-key is used to set the date display format for different convention of different counties.
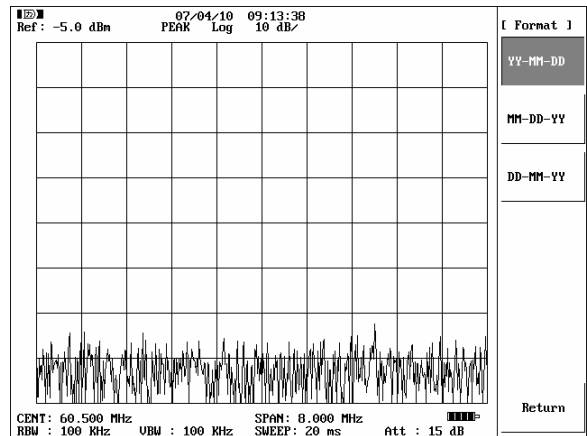
Figure 8.16 Date Format Selection menu

8.3.Software Update

If you need to update the software, you can ask us for new software. There are also two ways to update the software, one is by USB disk and the other by COM.

Update by COM: Copy the update folder to the PC, run "update.exe" in this folder. Press "Service>" soft-key in figure 8.2(b), select "RS Update" then the update will start.

Update by USB: Copy the update folder to the root directory of USB disk, connect it to the instrument and then reset the instrument. Press "CONFIG" key on the front-panel to enter the menu display as figure 8.2(b), the Press "Service>" soft-key and select "USB" then the update will start.
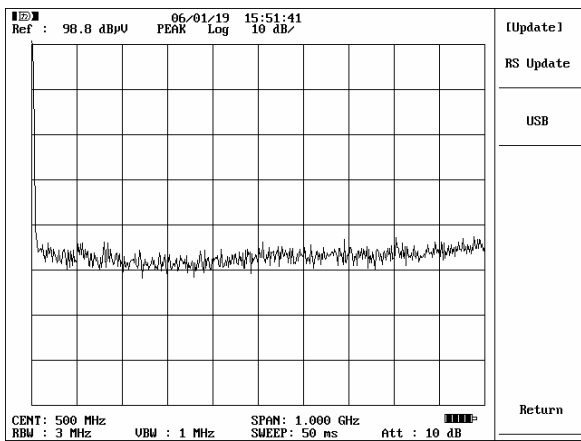
Figure 8.17 Update Menu

Note：

Make sure that the charger has been connected well before update. Otherwise if the battery is exhausted during the update course, the software of the instrument may be destroyed and can't be recovered except sending the instrument back to us.

8.4.Other Functions：

System Reset: The "RESET" key on the front-panel can realize the system reset.

9. Appendix

9.1.Specifications:

Frequency Specifications

Frequency range	1 MHz - 1000MHz
Frequency reference	
Aging	±1 x10^{-6}/year
Stability	±2 x10^{-6}
Temperature stability	±2 x10^{-6}(0 - 50)℃
Marker count accuracy	(S/N 25 dB, RBW/span 0.01)
Accuracy	±2 x10^{-6}±1count
Counter resolution	1 Hz
Frequency span	
Range	0 Hz (zero span), 200Hz - 1000MHz
Resolution	4 digits
Sweep and trigger	
Range	20mS - 250S (Span ≥ 200 Hz)
	20µS - 250 S(Span = 0 Hz)
Accuracy	≤±1%
Trigger type	free run, single, video TV(Option 3)
Resolution bandwidths	
Range	1KHz - 3 MHz in 1-3-10 sequence
	30Hz 100Hz 300Hz(option 2)
Bandwidth accuracy	<±15%
Selectivity (60 dB/3 dB bandwidth ratio)	< 5:1
Video bandwidths	
Range	30Hz - 1 MHz in 1-3-10 sequence
Stability	
Phase noise (10 kHz RBW, 100 Hz VBW, and sample detector)	< -110 dBc/Hz @100 kHz offset from CW signal
	< -90 dBc/Hz @10 kHz offset from CW signal

Amplitude Specifications

Measurement range	Displayed average noise level to maximum safe input level
Input attenuator	
Range	0dB - 55dB
Step	5dB
Internal preamplifier	
Frequency range	1MHz – 1000MHz
Gain	20dB
Noise figure	4dB
Max safe input	+128dBµV(Peak power /input attenuation>15dB)
	100VDC
Gain compression	≤0.5 dB (+98.7dBµV ATT=0 Preamplifier OFF)
	≤0.5 dB (+78.7dBµV ATT=0 Preamplifier ON)
Displayed average noise level (input terminated, 0dB attenuator,30 kHz RBW 100 Hz VBW, sample detector)	typ≤10 dBµV, 1 MHz - 1000MHz with Preamplifier OFF
	typ≤-10 dBµV, 1 MHz - 1000MHz with Preamplifier ON
Spurious responses	
Second harmonic	<-68 dBc for +88.7 dBµV tone at input mixer and Preamplifier
Third order intermod	<-68 dBc for two +88.7 dBµV tone frequency at
	input mixer and≥1MHz separation Preamplifier OFF
Residual responses (input terminated and 0 dB attenuator)	≤5dBµV 1MHz - 1000MHz
Display range	
Log scale	0.1 to 1dB/Division in 0.1dB step
	1 to 40dB/Division in 1dB step
Linear scale	8 divisions
Scale units	dBm, dBmV, dBµV, mV
Marker readout resolution	0.03 dB for log scale
	0.03% of ref level for linear scale
Traces	3 traces

Trace detector	Sample, Posi-peak, Neg-peak, Normal, Average
Marker functions	peak, next peak, marker to center, marker to ref, etc
Marker display	normal, delta, Fix marker and frequency counter
Reference level	-38dBμV - +143dBμV
Level accuracy	typ≤±1dB@+20℃
Resolution bandwidth switching uncertainty	<0.1dB
Input attenuator switching uncertainty	typ<0.3dB

Inputs/outputs

Front panel	
Calibrator output	
Frequency	150 MHz ± 2 x10^{-6}
Amplitude	88.7dBμV±0.5 dB @ +20℃
RF INPUT	
Input	BNC or F connector
Input impedance	75Ω/50Ω
SWR	typ<1.5 (10MHz – 1000MHz, ATT≥10dB)
USB PORT	
USB1.1	
Rear panel	
VGA OUTPUT	
KBD INPUT	
LPT	
RS232	

TG OUT(Option 5)

Output	BNC connector
Frequency range	1MHz – 1000MHz
Phase noise	<-80dBc/Hz@10KHz
Level range	-0dBm – -60dBm
Level accuracy	±1dB
Level flatness	±1dB
Harmonic distortion	≤–25dBc
Non-harmonic distortion	≤–35dBc
Output impedance：	75Ω/50Ω
SWR	≤2 (5MHz - 1000MHz, ATT≥10dB)

POWER Specifications

Battery type	Rechargeable Li-Ion battery 14.4V / 6Ah
Charger Type	Charger 19V /3.42A
Charge Time	<6 hours
Operating Time	>2.5 hours

Other Specifications

Temperature, Operating	0°C - +50°C
Temperature, Storage	-20°C - +55°C
Dimensions (W X H X D)	340mm X 160mm X 350mm
Weight (with battery)	9 kg
Display type	16cm (6.4 inches) TFT color LCD
Display resolution	640 X 480 pixels

CATV Measurement Specifications (Option 1)

Channel selection	Frequency, Channel
Channel plans	Custom plans, NTSC, PAL
TV channel amplitude range	20 dBμV - 125 dBμV ±1.0 dB@+20℃ for S/N >30 dB
TV Visual Frequency	
Accuracy	Carrier Frequency, ±2 x10
Resolution	1Hz
Visual/Aural Delta Frequency	
Accuracy	±200Hz
Resolution	1Hz
Visual/Aural Delta Amplitude	±1dB (S/N >30dB)

FM Deviation	
Range	100KHz
Accuracy	±2 KHz ≤80KHz
	±3 KHz ≥80KHz and ≤100KHz
HUM/Low Freq. Disturbances	
Modes	CW or Video (In-Service)
Range	1% - 20%
Accuracy	±0.5% from 1 - 5%
	±1% from 5 - 20%
Modulation Depth	
AM range	40% - 95%
Resolution	0.1%
Accuracy	±1.5%(CCN>40dB)
Signal type	Use VITS line with white reference
Carrier-to-Composite Noise Ratio	
Optimum range	92dBµV - 97dBµV with 0 dB Attenuation
	and preamplifier OFF
	72dBµV - 77dBµV with 0 dB Attenuation
	and preamplifier ON
Maximum CCN	60dB with ±1dB accuracy
	65dB with ±3dB accuracy
Resolution	0.1dB
CSO/CTB	
Optimum range	82dBµV - 87 dBµV with 0dB Attenuation
	and preamplifier OFF
	62dBµV - 67 dBµV with 0dB Attenuation
	and preamplifier ON
Maximum CTB/CSO	63dB with ±1.5dB accuracy and 78 channels
	70dB with ±4dB accuracy and 78 channels
Resolution	0.01dB
Cross modulation	
Range	60dB
Resolution	0.1dB
Accuracy	±2.0dB(X/mod＜55dB，C/N≥40dB)
	±4.5dB(X/mod＜60dB，C/N≥40dB)
In-channel Frequency Response	
Range	± 10 dB
Resolution	0.1 dB
Accuracy	± 0.25 dB
Differential Phase	**(Option 3)**
Accuracy	± 3° maximum
Differential Gain	**(Option 3)**
Accuracy	± 2% maximum
Luminance to Chrominance Delay	**(Option 3)**
Accuracy	± 40 nsec maximum

Digital Measurement Specifications (Option 4)

Modulation	
Modulation type	16/32/64/128/256QAM, QPSK ITU-T J.83 Annex A,B&C
Interleave capability	Up to 128 x 4 In Annex B,
	12 x 17 In Annex A/C
Constellation display	QPSK 16/32/64128/256QAM
	Full constellation with zoom capability
Digital Carrier Average Power Measurement	
Amplitude range	30dBµV - 120dBµV
Resolution	0.01 dB
Absolute accuracy	typ ±1.0 dB@+20℃
Measurement range	1MHz - 1000 MHz
Bandwidth range	200kHz - 200MHz
Modulation Error Ratio (MER)	
Range	22 dB - 40 dB
Accuracy	±0.5 dB 22 - 30 dB
	±1.0 dB 30 - 35 dB
	±1.8 dB 35 - 40 dB

Error Vector Magnitude (EVM)	
Range	0.65% - 4.1%
1 Second Period Bit Error Rate (BER), Before and After R-S Decoding	
Range	1e-9 - 2e-3
Symbol Rate	
Range	1 - 7 MS/s

9.2.Message Index

NO	MESSAGE	BECAUSE	RESOLUTION
#01	Please Input Channel	Before channel measuring, you haven't input a channel NO or a frequency.	Input a channel NO or a frequency.
#02	Please Remove Mod.	In the case of C/N measurement, after measuring the carrier level, system requires to turn off the modulation of the signal.	Turn off the modulate (Message will not disappear)
#03	Press Measure To Start	Confirms you to turn off the signal when measuring CTB/CSO	Press "Measure"
#04	Please Turn Carrier Off	Signal's modulate should be off when measuring CTB/CSO	Turn off the signal's carrier
#05	Confirm Channel Press again to exit	When exiting CTB/CSO or C/N measurement, you'd press "Return" twice. It may clue you on restore the signal.	Press again to exit, otherwise, continue measuring
#06	Must in Measure	Want to turn of the reference line before start scanning the standard channels	Press "Measure"
#07	Input Channel NO Enter to Continue"	Clue you to input a channel NO.	Input a channel NO, and press Enter.
#08	Visual Freq: MHz Enter to Continue	Clue you to input a carrier frequency	Input a frequency, and press Enter
#09	No Channel Table	User channel scan without a channel table.	Found a user channel table by auto or manus
#10	Table is Full	When founding user channel tables by manus, the number of the channel exceeds the limit.	Delete inutility channels
#11	Channel Added	When add a user channel success	___
#12	Invalid Frequency	When add a user channel , the input frequency is out of range	Input Range：1Mz~1000MHz
#13	Channel Deleted	When delete a user channel success	___
#14	Invalid Channel	When add a user channel, the input channel NO is out of range.	Channel NO range：1~199
#15	Already Exist Overwrite Anyway?	When add a user channel, the input channel is already exist.	Press Enter to overwrite, ESC to cancel
#16:	Remove RF Input	Base noise calibrate with a RF input	Remove the RF input
#17	No Such Plan	In the case of FCC, use a plan, which doesn't exist.	Found the plan
#18	Select Time 1 If measured by manu	If not measured automatically, select Time1	Select Time 1
#19	___	___	___
#20	___	___	___
#21	Choose FM First	Changing the FM gain	Change the modulate mode from AM to FM
#22	Turn Mode On Spectrum Analyzer"	Change mode into double window mode when the current mode is not in Spectrum Analyzer.	Press Mode and then press Spectrum Analyzer
#23	Invalid CBW/CSP	When measuring CSP, Power or OBW, the Frequency parameter is not suitable	Try to reduce the CBW or CSP.
#24	Please Turn Off Peak Table	With the peak table on, trying to do follows: search the next peak, next peak right, next peak left, move the peak point to the center or top position; press normal menu.	Turn off the peak table
#25	Please Turn Off Mark Table	When mark table is on, trying to do following things: turn on the frequency counter, normal mark, delta mark, fixed mark; push the mark to the center, to the top position; search a peak.	Turn off the mark table
#26	Please Turn Off Freq Count	When the frequency counter is on, trying to do the following things: turn on the delta mark, fixed mark, multi marks; push the mark to the center, to the top position.	Turn off the frequency the frequency couter.
#27	Cannot reach N dB points	No peak points on the screen or the peak point is on the edge of the screen.	Modify the center frequency, enlarge the span or minish the RBW
#28	Please turn the Displine ON	Turn on the instant function with the reference off.	Turn on the reference line
#29	Calibrate Failed	Frequency or amplitude calibration	Confirm the calibrate line is connected.
#30	Not Enough Space	Not enough space to save pictures	Delete inutility pictures.
#31	Please Turn Off redundant Marker(s)	When delta mark, fixed mark or multi marks is on, trying to turn the mark noise on.	Turn off the reluctant marks
#32	Turn One Trace on Write Mode	Turn on NdB or Instants function when there is no trace in write mode	Press trace and turn at least on trace in "write"
#33	Data'll be lost Continue anyway?	Want to restore to the manufacture	If you press yes, all bmp files, user channels etc. will be lost
#34	Doesn't Support USB in this version	Want to update by the USB, but this version doesn't support it.	_____
#35	No Such a File	Transmit or delete a file not exist	Save a picture

NO	MESSAGE	BECAUSE	RESOLUTION
#36	Translate Failed Confirm Port	When transmit BMP files can't connect to the host	Confirm the connection and the baud rate
#37	Not Connected	Doesn't connect to a printer; the printer is not open, doesn't support this printer	Confirm the connection; Confirm the model.
#38	No Paper	No paper	Add some paper
#39	Printer is Busy	Printer is Busy	Wait for a while
#40	Select a Printer	Haven't choose a printer	Press config -> Print/Save -> Print
#41	Input a Name: Enter To Continue	When save a BMP file, input a filename (number)	Input a number, maximum 8 digitals
#42	Input a Time: By Press Digital Key	When time display is on and you choose time button.	If you want to change the current time, just press the digital key to continue.
#43	Calibrate Finish	After the frequency, amplitude or base noise calibrate is success finished.	———
#44	Please Turn Off Double Window	Try to turn on the volume , mark table , peak table in double window mode;	Press "WINDOW", and then select" Window Off "
#45	Please Input 0-9	While saving the file, the file name should be positive integer.	Input number 0-9.
#46	Please shut down And restart	After update, you should shut down the power and restart DS8821 again.	Shut down the power
#47	Please augment RBW	Set the count "On" while RBW is smaller than 3kHz	Change RBW to larger than 1kHz
#48	Test unfinished	View last statistic result while last statistic is never finished	View after finish at least one statistic.
#49	Please Exit Aux Measure.	Change the parameters while system is in channel power measure state.	Exit the channel power measure state.
#50	Turn Off FM	Change the parameters while system is in FM demodulation state.	Turn the demodulation to AM.
#51	Turn Off TV Trig	Change the parameters while system is in TV-H trigger state.	Change the trigger to free run mode.
#52	Option not Installed	Use the functions that need options support.	Connect to us and purchase the options.
#53	Please turn off Gate	While measure CSO/CTB in "Gate" "On" state, press "Next/Last Chan" soft-key.	Set the gate to "Off".
#54	Already Exist Overwrite Anyway?	The file has existed while saving the file.	Press ENTER to confirm or ESC to cancel.
#55	Please Select File(s) First	Try to delete or transmit file(s) before selecting them.	Select file(s) firstly.
#56	Really del the flie(s)	Prompt user to confirm	Press ENTER to confirm or ESC to cancel.
#57	Really Trans the flie(s)	Prompt user to confirm	Press ENTER to confirm or ESC to cancel.
#58	Stop FREQ must Greater than start	The limit line frequency setting is illogicality.	Set the start frequency smaller than stop frequency.
#59	Low Battery	The electrical voltage is insufficient while user try to update the software.	Plug in the charger.
#60	Doesn't support USB Devices	Some DS8821 don't support USB devices.	It is inextricable.
#61	No USB devices detected	Before transmitting data to USB disk, the USB disk must be connect well.	Plug the USB disk and reset the system.
#62	UpDate File is half-baked	The update file is insufficient.	Connect to us for update.
#63	Copy Finished	The file copy from DS8821 to USB disk is finished.	User can go on to do other measures.
#64	---	---	---
#65	Count is closed	The count will automatically change to "Off" while user set the RBW to smaller than 3kHz.	Don't change the RBW to smaller than 3kHz if you need the count "On".
#66	Can't trig a line	Can't find line synchronization signal. Perhaps the signal is too weak.	Decrease the attenuator value.
#67	Turn Off HFC	In HFC mode user can't open peak table.	Change to normal spectrum mode.
#68	Can't do FCC measure now	Can't do FCC measure in scan channel menu.	Return to normal mode and set the time again.
#69	Turn ON TG.	The tracking generator is closed when performing the tracking generator's power calculation and normalization	Set the tracking generator to "On".
#70	Turn Log ON	When performing the power normalization of the tracking generator, the analyzer should in the log mod	Change the "Scal" state in the amplitude menu to "Log".
#71	Turn Gate ON	In CCN and CSO/CTB measurement, changing the "View" softkey to "Vid" should firstly setting the "Gate" to "On".	Set the "Gate" to "On".
#72	Can't delete an active plan	In "Channel Table", user can't delete the active plan	Activate another plan, then delete this plan
#73	Please use Unfreeze mode	In QAM equalizer display, the frequency response and Group delay only can be refreshed when equalizer in "Unfreeze" mode.	Set the equalizer to Unfreeze mode to see the frequency response and group delay
#74	Can't delete the last channel	When there is only one channel in the selected	Delete the selected channel table

NO	MESSAGE	BECAUSE	RESOLUTION
		channel table, user can't delete it.	
#75	No item	System measure is selected, but there is no test item in the active TV plan is set to "enable".	Edit the active TV plan. Set the wanted items to enable.
#76	No channel	The input channel number doesn't exist in the active TV plan	Input another existed channel or edit the TV plan to add the needed channel
#77	Channel already Exist	The input channel number has existed, when user edit the channel number.	Input another channel number.
#78	Delete channel anyway?	Delete an selected channel	Press "ENTER" to confirm the "Delete" or press "ESC" to cancel the command