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Vincit Omnia Veritas

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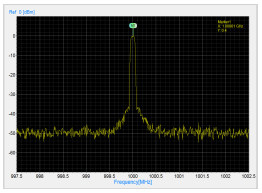
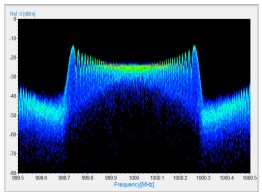
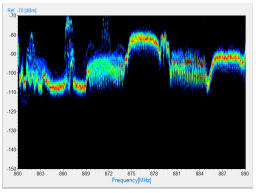
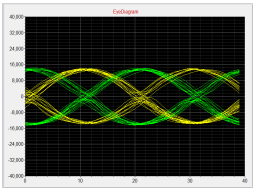
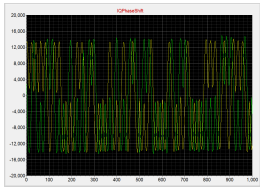
Triarchy® VSA6G2A/B
USB Vector Spectrum Analyzer
Operating Manual

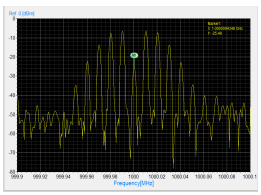

CW Signal Spectrum

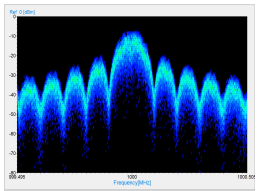

Wide Band FM signal

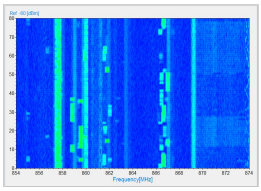

Cell phone signal at air

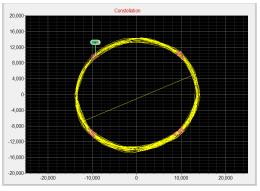

MSK eye Diagram

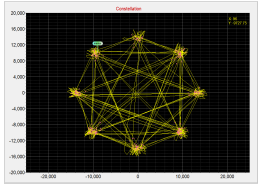

MSK I&Q waveform


Narrow band FM signal


QPSK signal density


Waterfall display for cell signal


Constellation of MSK signal


Constellation of 8PSK signal

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USB Vector Spectrum Analyzer Operating Manual

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Technical Support

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Contents

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1 Introduction

VSA6G2A/B is a USB RF vector spectrum analyzer that plugs on PC and works with PC application.
For VSA6G2A/B: the RF frequency range is from 100Hz to 6.2GHz, amplitude measurement range will be -140dBm~24dBm. RBW range is from 0.2Hz to 10MHz.

VSA6G2A/B will be very easy to use. The application's user interface is designed to be just like the front panel of normal desktop spectrum analyzer, allowing users to easily pick up and use the application intuitively without a high learning curve . If your PC or tablet support touch screen, the user experience will be even more realistic to a desktop spectrum analyzer.

VSA6G2A/B have demodulation function, it can measure analog and digital modulation signal, such as AM,FM,PM, MSK and QPSK.

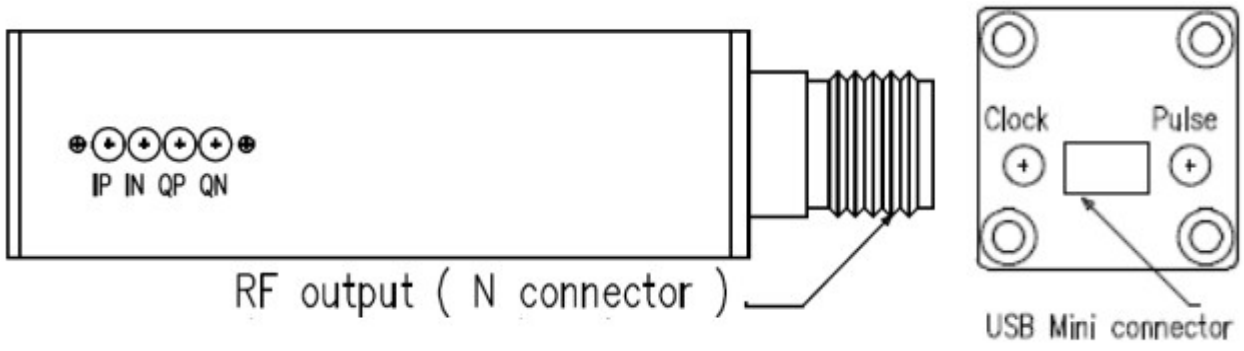
VSA6G2A/B also have I&Q signal output ports, it can work as wide band I&Q receiver platform.

1.1 VSA6G2A/B Product Package Overview

VSA6G2A/B product package will be:

1: USB Vector Spectrum Analyzer device (100mmx25x25)	one piece
2: mini type of USB cable	one piece
3: SMA to MMCX cable	one piece
4: N to SMA adapter	one piece
5: CD with PC application program and document	one piece
6: 160x110x40mm product case	one piece

1.2 USB Device Overview



RF input	N connector (female)	RF signal input
USB connector	Mini-B USB connector	interface with PC
IP	MMCX connector	I port positive Output
IN	MMCX connector	I port negative Output
QP	MMCX connector	Q port positive Output
QP	MMCX connector	Q port negative Output

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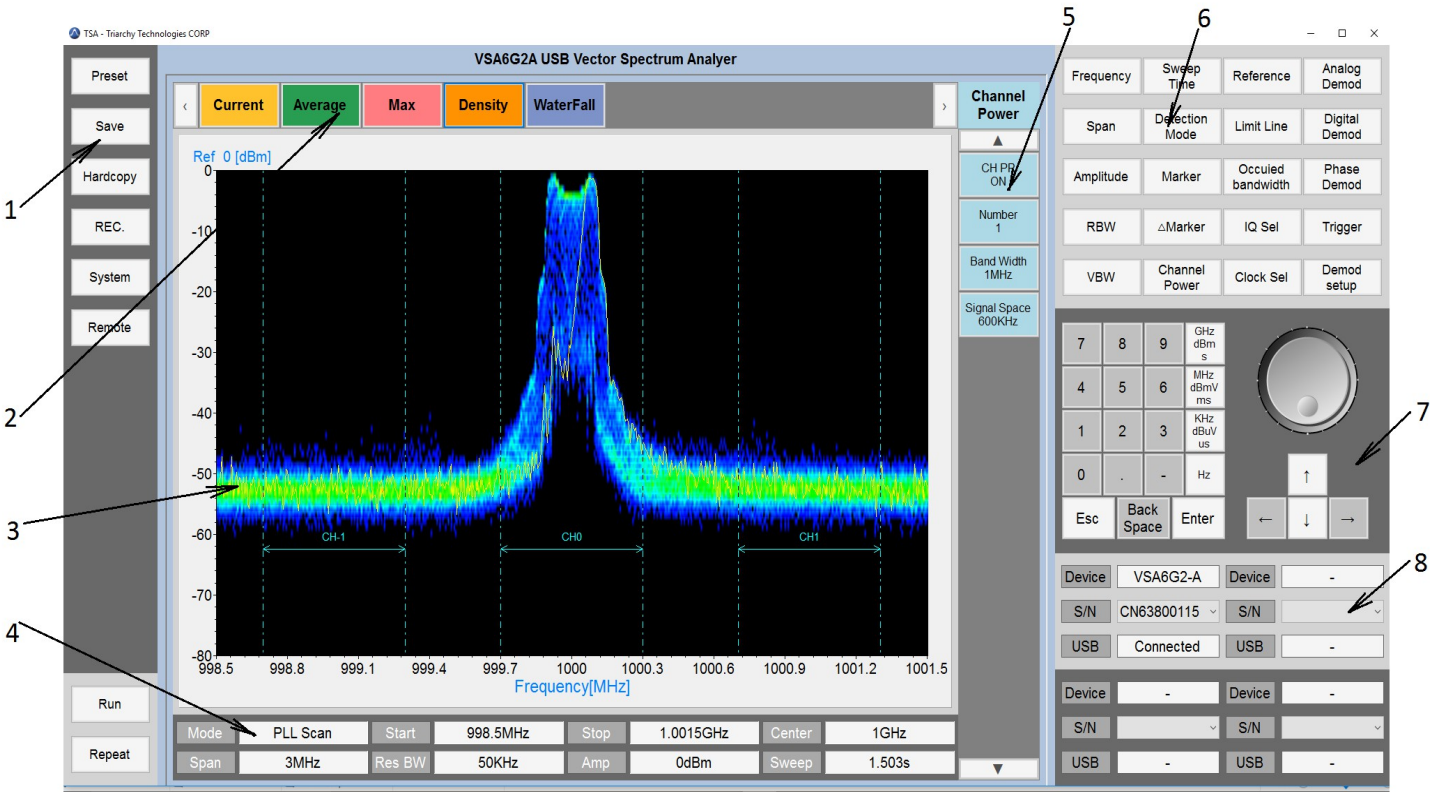
Clock	MMCX connector	Clock Output
Pulse	MMCX connector	Trigger signal Input

1.3 VSA PC Application Overview



1: **Utility keys**

Allows user to access the system level function. Function detail will be shown on second function keys

2: **Display Function keys**

Click the Display Function keys, it will be shown accordingly display function such as Current, MAX or density .

3: **Main Display area**

This area will display signal spectrum waveform, and also shown density and waterfall of signal spectrum. This area will be shown signal demodulation waveform such as EVM, eye diagram, constellation. The image can be moving by keep hold left key of mouser and moving the mouser.

4: **Status block**

Status block shows the main parameter setting for signal spectrum measurement: such as frequency, amplitude, RBW, sweep and working mode.

5: **Second functions keys**

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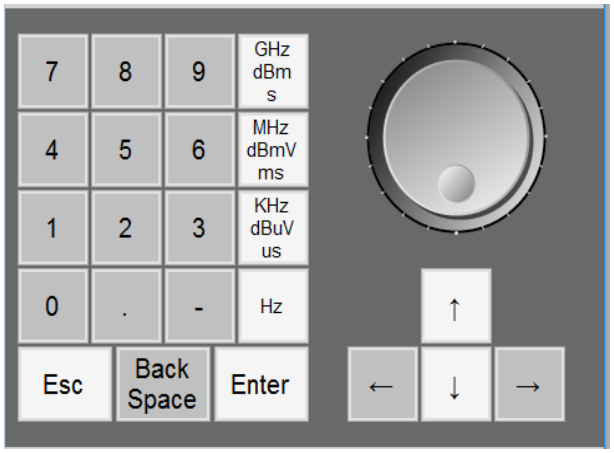
Second function keys will extend secondary functions relative to the primary function keys and utility key . It is similar to soft key in most of equipment which is location on side of screen.

6: **Function keys**

Most of major equipment settings are done by the Function keys.
General setting for Spectrum analyzer will be:
Input Frequency, Span, amplitude. Then measured RF signal will be shown properly at display area.
General setting for demodulation will be:
Select Demodulation method and turn on it, go into Demod setup key to do more operation.

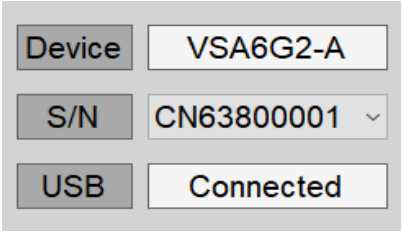
7: **Digital input keys**

Digital input keys will input digital and units for frequency, amplitude and timing. This standalone input key is similar to desktop equipment.



8: **USB connection area**

When VSA6G2A/B is plugged in the PC, USB connection area will display the product model name, S/N and connection status.



1.4 Electrical Requirements

1.4.1 Specification for Frequency

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Frequency range :	100Hz~6200MHz
High Band :	1MHz ~6200MHz
Low Band :	center frequency range 1KHz ~1MHz usage frequency range 100Hz to 2MHz
Frequency mini setup step:	1Hz
Reference clock output:	default value 10MHz, MMCX connector at rear panel. Output value can be set at 2.5MHz, 2.86MHz, 3.33MHz, 4MHz, 5MHz, 6.67MHz, 10MHz, 20MHz.
Reference clock accuracy:	
Stability Over Temperature:	±0.28 ppm (temperature -10C~+50C)
Aging rate:	±1 ppm / year Max
Span range:	100Hz~6188MHz
Span range for PLL scan mode:	1.35MHz~6188MHz
Full span frequency range:	12MHz~6200MHz
Span range for FFT scan mode:	100Hz~1.35MHz only 100Hz, 200Hz 300Hz and 400Hz value when span low than 400Hz
Span setup for Low Band:	Span range is double of center frequency low band will be working at FFT scan mode
RBW range:	0.2Hz~10MHz
RBW range for PLL scan mode:	10KHz~10MHz Auto setup with proper Value Manual setup value with 10KHz, 20KHz, 30KHz, 50KHz, 100KHz, 200KHz, 300KHz, 500KHz, 1MHz, 10MHz
RBW range for FFT scan mode:	0.2Hz ~27KHz Auto setup with span/100 Manual setup with span/50~500 (10 step)
VBW range:	2.3KHz~300KHz only can be setup at PLL scan mode
Frequency readout accuracy:	Frequency marker resolution is 0.1Hz

1.4.2 Specification for amplitude

Measurement range:

High band for CW signal:	Displayed average noise level (DANL) to +24dBm (Up than 50MHz)
High band for pulse signal:	Displayed average noise level (DANL) to +28dBm (Up than 50MHz)
Low band for CW and pulse:	Displayed average noise level (DANL) to +10dBm
1MHz ~50MHz signal:	The max input level will vary from 10dBm to 24dBm (CW) or 28dBm (pulse) with frequency changing Pulse signal: 5% duty cycle of 4620us period

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Ref setup range :

High band:	-70 dBm~+30dBm
Low band:	-50 dBm~+30dBm
	Setup resolution 0.25dB

Max input level: CW RF signal 30dBm less than 1min, when Ref=+30dBm
DC input Max +/-25V

Displayed Average Noise Level (DANL):

100Hz~1MHz (Low Band):	-90dBm	ref=-50dBm
1MHz~500MHz(High Band):	-140dBm	ref=-70dBm, Span=100Hz, RBW=1Hz
500MHz~4.5GHz(High Band):	-135dBm	ref=-70dBm, Span=100Hz, RBW=1Hz
4.5GHz~6.2MHz(High Band):	-130dBm	ref=-70dBm, Span=100Hz, RBW=1Hz

Level measurement uncertainty:

Absolute level uncertainty at 1GHz:	1.5dB
Frequency response 50MHz~6.2MHz:	2dB

Level display range:

Log scale:	8~80dB, DIV range 1~10
Scale units:	dBm, dBmV, dBuV, dBuV/m, dBW/m2
Trace points:	501 ~1501 points for PLL scan mode, 461 points for FFT scan mode
Number of marker:	5
Detection mode:	Sample, Average, Max, Min, Normal
Trace functions:	Current, Average, Mix hold, Density, Waterfall

Level readout accuracy: Level marker resolution is 0.01dB

1.4.3 Specification for Sweep

Sweep time: 3.33ms to 200s

PLL scan mode sweep time:	262ms to 200s
FFT scan mode sweep time:	3.33ms~40s

Full scan time: 820ms

1.4.4 Trigger Function

Trigger source:	external trigger signal from rear MMXC connector
Trigger signal level:	3V3 TTL level

1.4.5 Specification for Analog demodulation

Demod Frequency range:	10Hz~50KHz
AM demodulation index range:	5~95%
FM demodulation deviation range:	100Hz~100KHz
PM demodulation phase range:	-160~+160 degree

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ASK data rate:	50b/s to 50Kb/s
FSK (GFSK)data rate:	50b/s to 50Kb/s
PSK data rate:	50b/s to 50Kb/s

1.4.6 Specification for Digital demodulation

Type of digital demodulation:	MSK, GMSK
Display type of demodulation:	I&Q raw data, I&Q Phase shift, EMV, Eye diagram, Constellation
Range of sample rate:	200b/s ~120Kb/s

1.4.7 Specification for Phase Demodulation

Type of phase demodulation:	BPSK, QPSK,8PSK
Display type of demodulation:	I&Q raw data, I&Q Phase shift, EMV, Eye diagram, Constellation
Range of sample rate:	200b/s ~120Kb/s

1.4.8 External I&Q output

Analog I&Q signal output:	4 ports of MMCX connector, IP,IN, QP,QN
VSA6G2A LP filter range:	4MHz~40MHz bandwidth with 290KHz step
VSA6G2B LP filter range:	40MHz~128MHz bandwidth with 800KHz step

1.4.9 General Specification

Temperature range:	working range: -10C ~+50C
	Stored range: -50C ~+70C
Power source:	5V from USB port
Dimensions:	115mm(L)x25mm(W)x25mm(H)
Weight:	95g

1.5 PC System Requirements

Supported Operating Systems

- Windows 7/8/10 – Supports 64 and 32-bit, (64-bit recommended) Minimum System Requirements
- Processor – i5 and i7 are better for VSA program, i3 will be dropped the performance at FFT scan mode.

1.6 Product internal option

The product internal options:

A: High speed I&Q data receiver: To pick up more than 100MHz bandwidth I&Q signal into high speed ADC, using USB 3.1 port to working as real time spectrum analyzer.

B: High frequency band module: To extend the frequency range up to the 13.5GHz, Spectrum analyzer working range will be from 100Hz to 13.5GHz.

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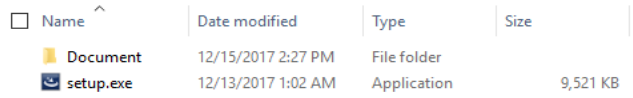
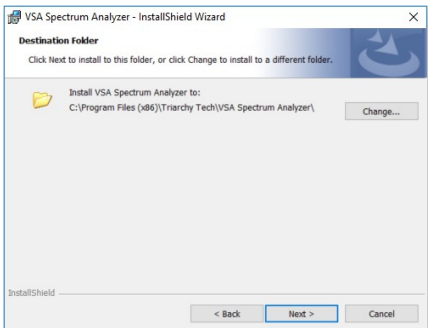
2 Getting Started

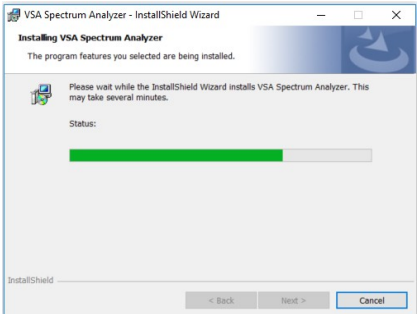
2.1 Install PC Application

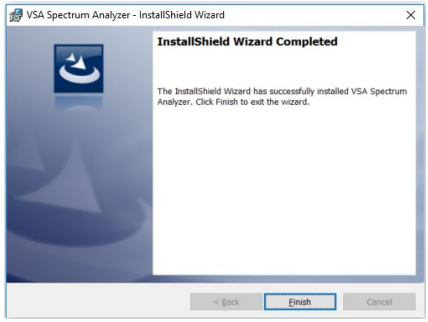
Open the CD, go into the SW_file folder, you can find setup.exe and Document folder, click setup.exe to install the VSA program. Or copy SW_file folder into PC temp folder to install the program.



When you finished the installation, the VSA icon will be shown on the desk







After installation, the program file will be installed at program file folder.
C:\Program Files (x86)\Triarchy Tech\VSA Spectrum Analyzer

The application data will be generated at Document folder:
C:\Users\Username\Documents\Triarchy Tech\TSA Spectrum Analyzer

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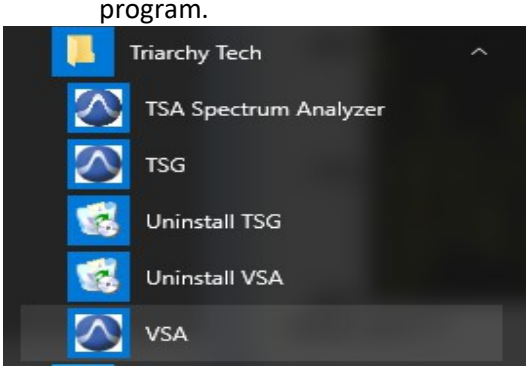
Calibration	12/15/2017 2:29 PM
Hardcopy	11/25/2015 12:26 AM
LimitLine	12/15/2017 2:30 PM
Record	12/15/2017 2:30 PM
ReferenceLine	12/15/2017 2:31 PM
Settings	12/15/2017 2:33 PM

Calibration folder:	This folder is reserved for calibration update, it is empty now, the calibration data already installed at USB device.
Hardcopy folder:	stores the image file which generated by Hardcopy key.
LimitLine folder:	stores the limit line files.
Record folder:	reserved for TSA application.
ReferenceLine folder:	stores the reference line files.
Setting folder:	save preset, and specific setting, then using Preset key to resumed the previous setting.

2.2 Uninstall PC Application

Go into the Triarchy Tech folder from Start up key of Windows. Click the Uninstall VSA to remove the VSA program.



You also can use control panel to uninstall the VSA program.

2.3 First Working Example

During the first time using VSA6G2A product, Just turn on the VSA PC application first, then connect VSA6G2A to PC via USB cable, VSA program will be shown the USB device hardware information at USB connection area.

The VSA display first show only noise waveform without RF SG connected. Then, connect device with RF signal generator, and turn RF SG output to: Freq=1GHz, Amp=0dBm in CW mode. The signal spectrum waveform can be shown at center area.

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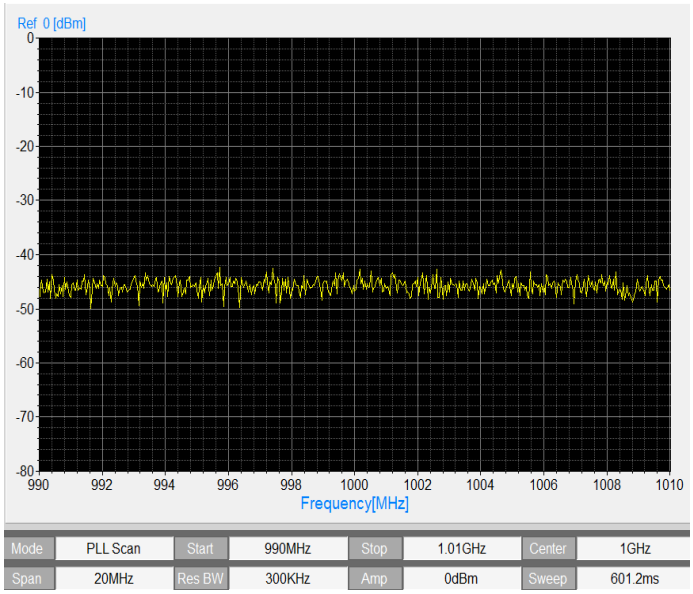
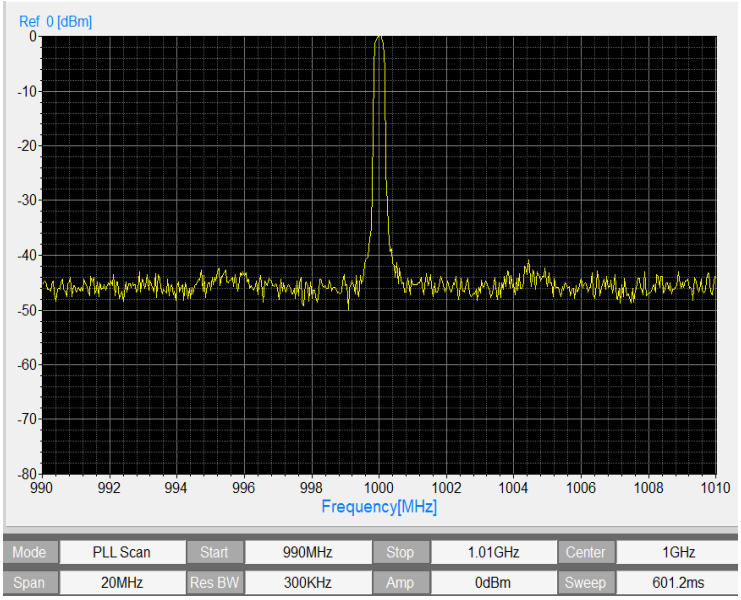


Spectrum display without signal input



CW signal measurement

2.4 VSA Utility keys setting

Preset

When clicking the Preset key, the second function key will be shown:

Preset x (x=1~6) can be clicked, then system setting will go into the preset x status.

Preset x can be setup at **Save** key

Custom key will be allowed user to recall more setup.

Last setting key select to ON, when VSA program turn on again or USB device plug off and on, all system setting will go to last setting.

Last setting key select to OFF, when TSG program turn on again or USB device plug off and on, all system setting will go to device hardware default setting.

Save

To stored the current display setup into corresponding key such as Preset x or Custom.

Hardcopy

Click hard copy, the image of measurement will be save at document folder.

REC

Reserve for TSA series product.

System

When clicking the System key, the second function key will shown：

Load Cal File :

update the calibration file (TA25_CN6380xxxx_Cal.txt) into USB device.

Calibration file already stored at USB device, and don't need to load cal calibration.

Density:

Select Density value Low, Normal and High.

Freq Offset:

Manually frequency calibration, Please turn it to 0Hz when working at external clock synchronize.

Amp Offset:

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Manually amplitude calibration.

Remote

Reserve for TSA series product.

Run/Stop

Select Run, all system will be working as normal.
Select Stop, all system will be stop to work.

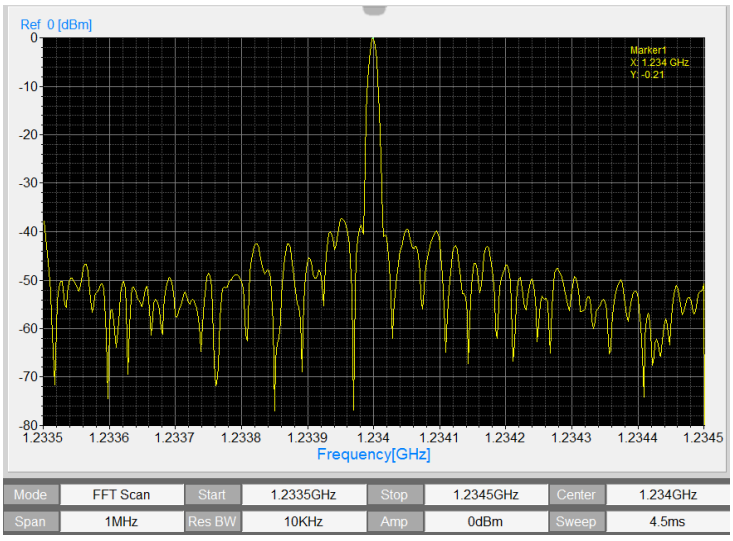
Repeat/Single

Select Repeat, display will repeated frame one by one .
Select Single, display will be only shown one time of frame.

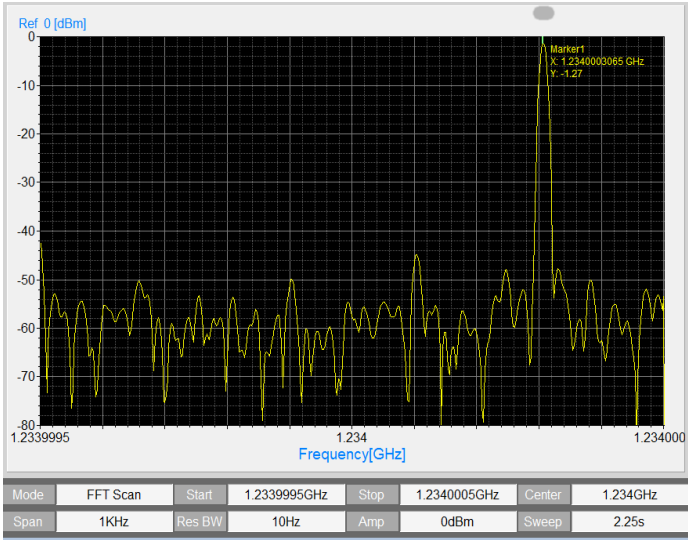
3 Operations

3.1 Measure RF signal with 100Hz span

First using 1MHz span to measure RF signal with frequency 1234MHz , then reduce the SPAN to 1KHz, the frequency error can be found, it is 306.5Hz. each SA and SG shall have small frequency error when using small span to measure the RF signal. Input this error (306.5Hz) into Freq Offset at System key.



Measure 1234MHz signal with 1MHz SPAN



Measure 1234MHz signal with 1KHz SPAN

After Freq Offset setup value, the spectrum peak waveform will go into center location. Then SPAN setting can be reduced to 100Hz. The signal peak can be found at display with 100Hz span.

When SPAN set to 100Hz, the spectrum analyzer will be almost working as frequency counter, the minimum RBW can be set to 0.2Hz, the frequency marker resolution is 0.1Hz. Internal LO frequency setup resolution is 1.2Hz, so that reading error will be:

for 1Hz, reading error is 20%
for 5Hz, reading error is 4%
for 10Hz, reading error is 2%

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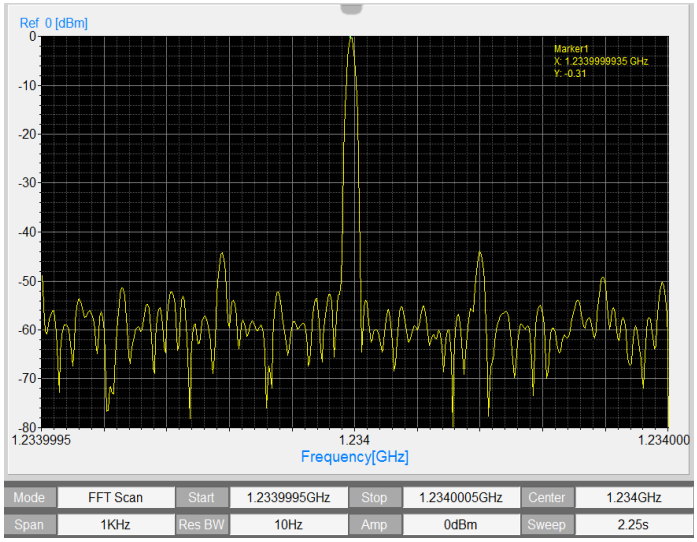
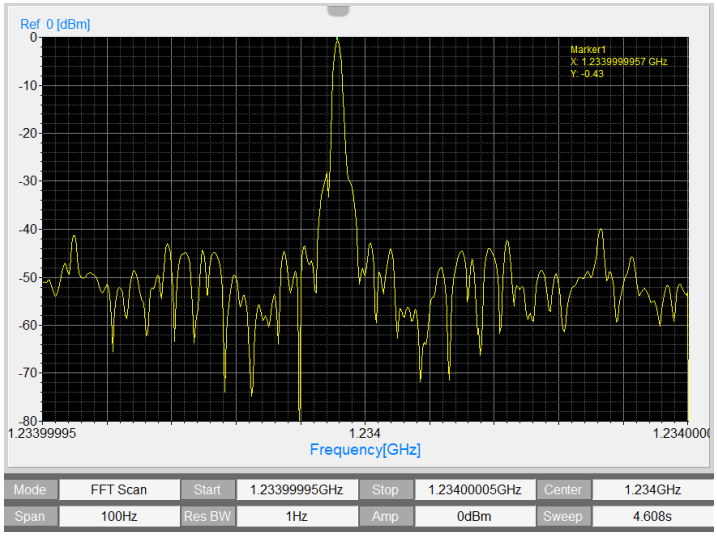


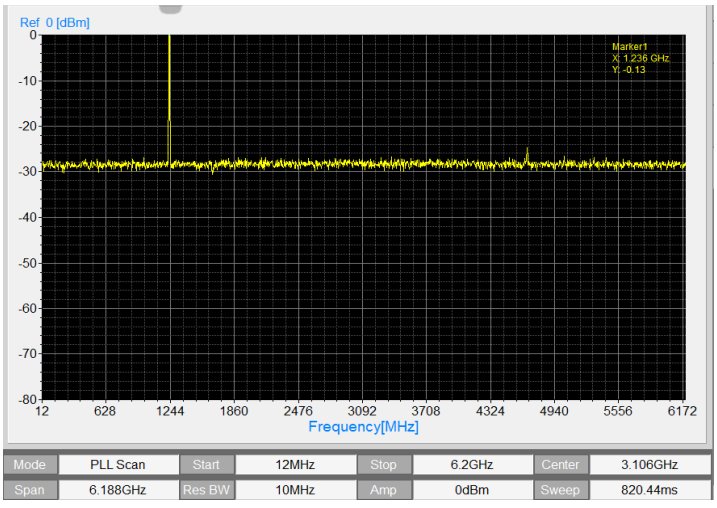
Measure 1234MHz signal with 1KHz SPAN after manual calibration



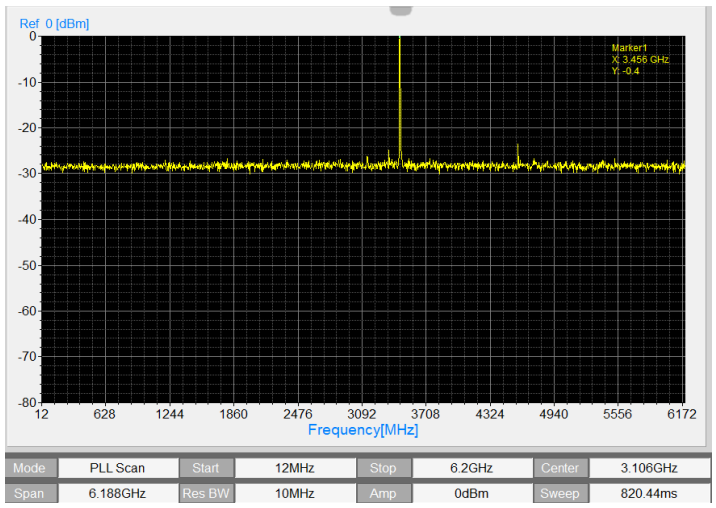
Measure 1234MHz signal with 100Hz SPAN

3.2 Full Span measurement

Set RF signal frequency at 1234MHz with 0dBm level, Set VSA span to full span, then change the SG frequency to 3456MHz. The sweep time for full span is 820ms. Full span range is from 12MHz to 6200MHz.



Measure 1234MHz signal with full span



Measure 3456MHz signal with full span

3.3 Measure Small level of RF signal

Set RF signal generator to 1234MHz with -100dBm small level. Set VSA panel frequency to 1234MHz, and Amplitude level to -70dBm, Span set at 10MHz, VSA6G2A will be working at PLL scan mode, noise level is around -110dBm, signal peak is around -100dBm.

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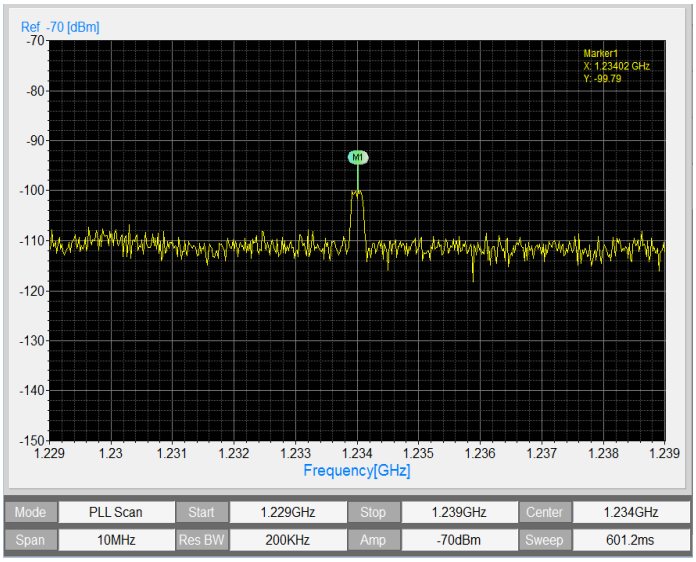
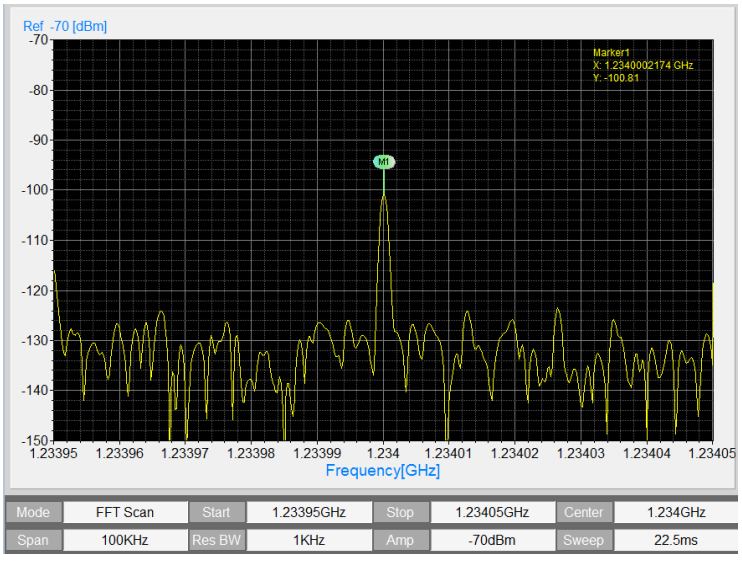
Change the SPAN to 100KHz, VSA6G2A will be working at FFT scan mode, noise level is around -130dBm, signal peak level is -100dBm, it is above noise level with 30dB.



Measure -100dBm signal with 10KHz SPAN at -70dBm ref

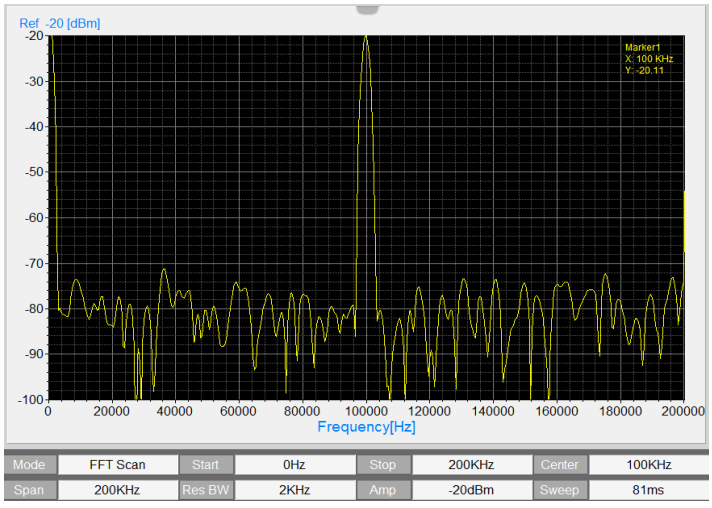


Measure -100dBm signal with 100KHz SPAN at -70dBm ref

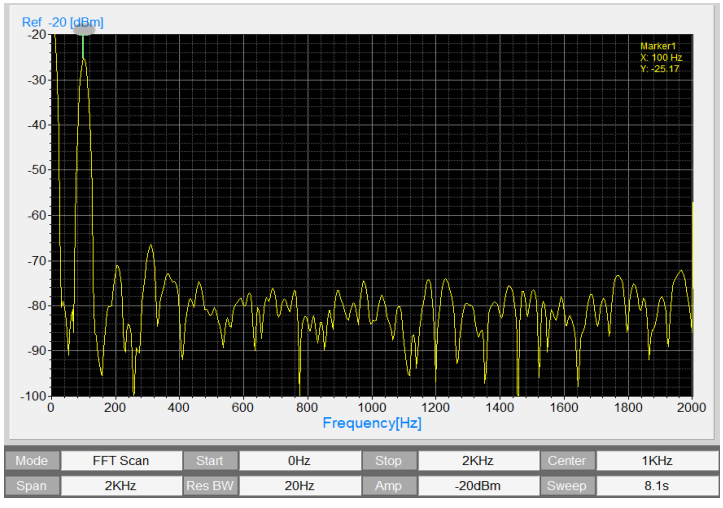
3.4 Measure the 100Hz and 100KHz signal at low Band

Set signal generator to 100KHz with -20dBm level. Set VSA panel Frequency to 100KHz, and Amplitude level to -20dBm, SPAN will be auto set at 200KHz, the Spectrum waveform will be shown the peak at center area. Please note: Zero IF peak is always at Zero Hz (left end), it need to use Next Peak Right to make the marker point at signal waveform peak.

Change the signal generator frequency to 100Hz, Set VSA panel frequency to 1KHz, the 100Hz signal waveform can be shown at display left side. It is lowest frequency can be measured.



Measure 100KHz signal at low band



Measure 100Hz signal at low band

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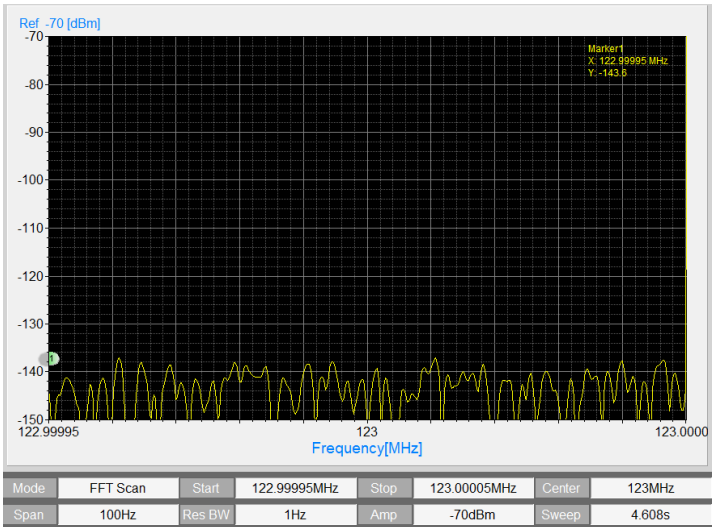
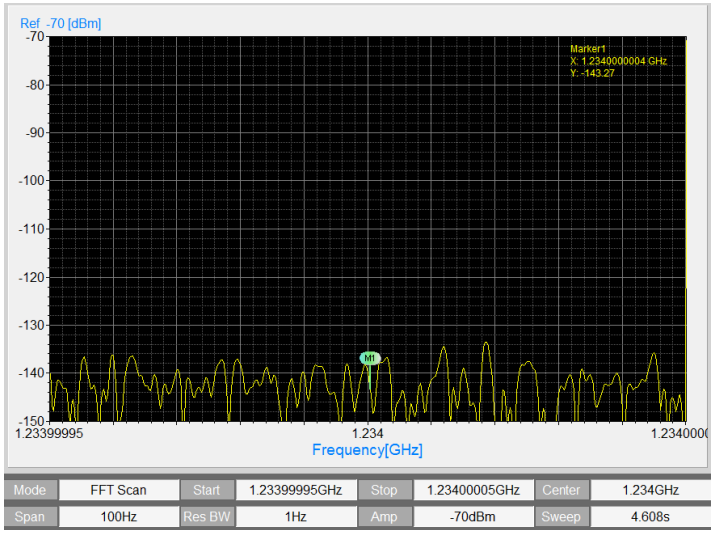
3.5 Displayed Average Noise Level (DANL)

Connect VSA6G2A input port with RF 50 ohm terminal. Set VSA panel frequency to 123MHz, 1234MHz, 3456MHz, 5678MHz. Span to 100Hz with RBW 1Hz, the Amplitude to -70dBm.

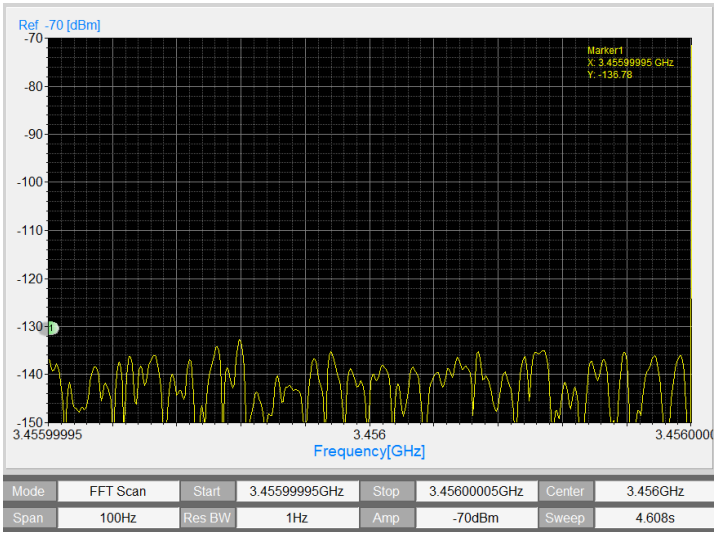
The noise level is around -140dBm~-130dBm. (RBW setting is 1Hz)



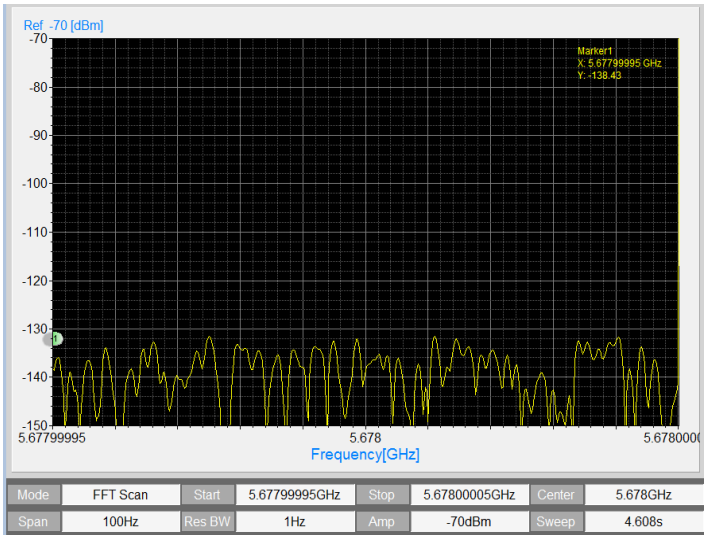
Noise level is around -140dBm when Freq=123MHz



Noise level is around -135dBm when Freq=1234MHz



Noise level is around -135dBm when Freq=3456MHz



Noise level is around -130dBm when Freq=5678MHz

3.6 AM PM FM signal spectrum

Setup RF signal generator to output AM signal with modulation frequency at 400Hz, and modulation index at 50%. VSA display panel will be shown the two sidebands at fc+fi and fc-fi.

Setup RF signal generator to output PM signal with modulation frequency at 400Hz, and modulation phase at 90 degree. VSA display panel will be shown the multiple sidebands with frequency interval at 400Hz.

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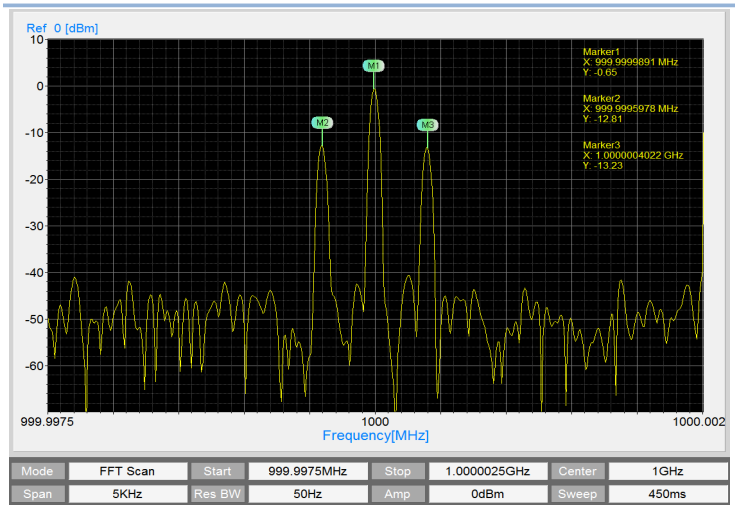
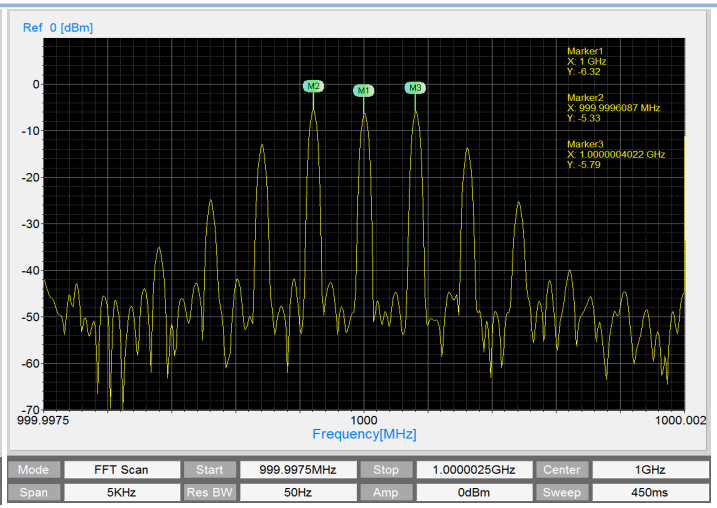
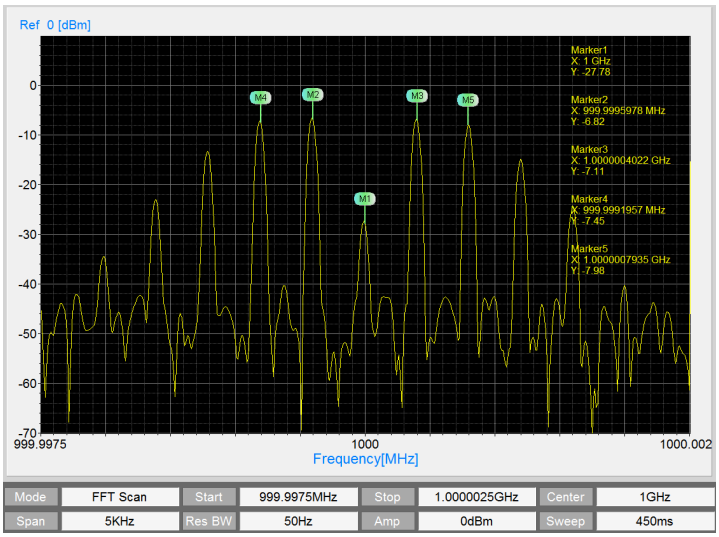


Measure AM signal

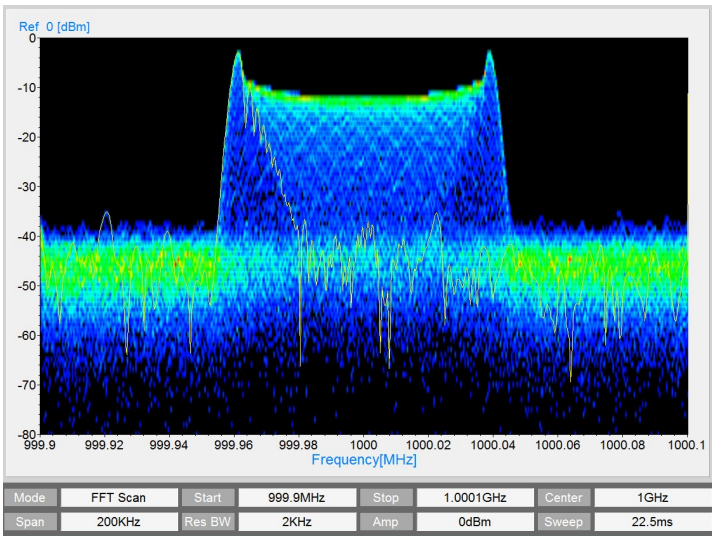


Measure PM signal

Setup RF signal generator to output FM signal with modulation frequency at 400Hz, and frequency deviation at 1KHz (narrow band FM, mf=2.5), and 40KHz (wide band FM, mf=100). VSA display panel will be shown narrow FM with multiple sidebands which is a little similar to PM spectrum. But wide band FM will occupied more wide bandwidth, set SPAN to 200KHz to check wide band FM spectrum waveform. Using density display will be better to display the varied spectrum signal.



Measure narrow band FM signal (mf=2.5)



Measure wide band FM signal (mf=100)

3.7 Detect cell phone signal in the air

Directly connect VSA6G2A USB device with antenna, the air wireless signal can be pick up. Because of the signal level at air is smaller, so that Amplitude level at VGA panel shall be set to smaller, such as -50dBm, -60dBm or -70dBm.

The cell phone base station always transmit signal into air, it will be easy to detect it, setup frequency range from 860MHz to 890MHz, the cell phone 2G, 3G, 4G signal can be found.

The density display can be shown signal spectrum with detail content, current display is not easy to show full picture of signal spectrum. When turn on the density display, the feature of signal spectrum can be recognized.

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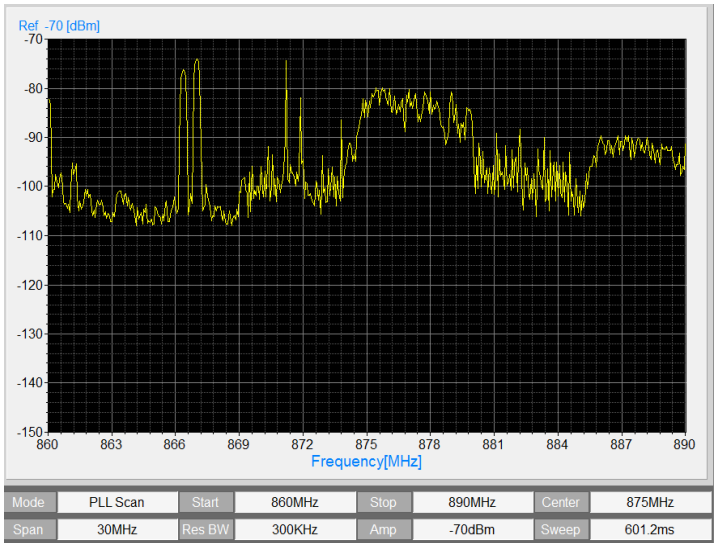
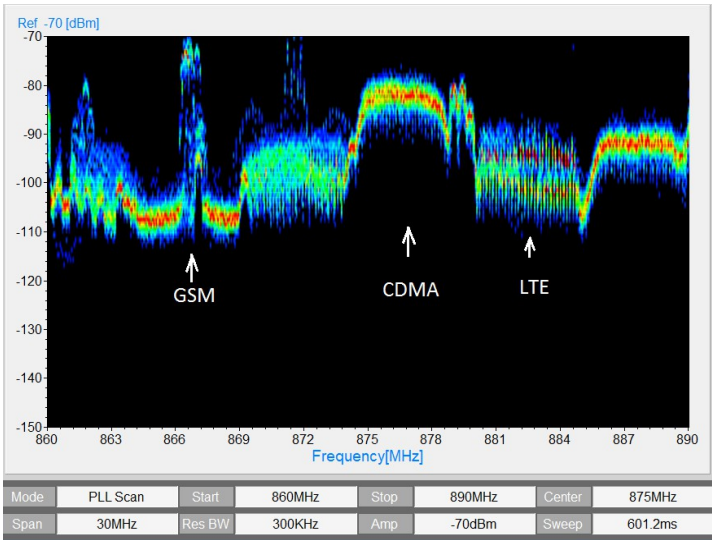
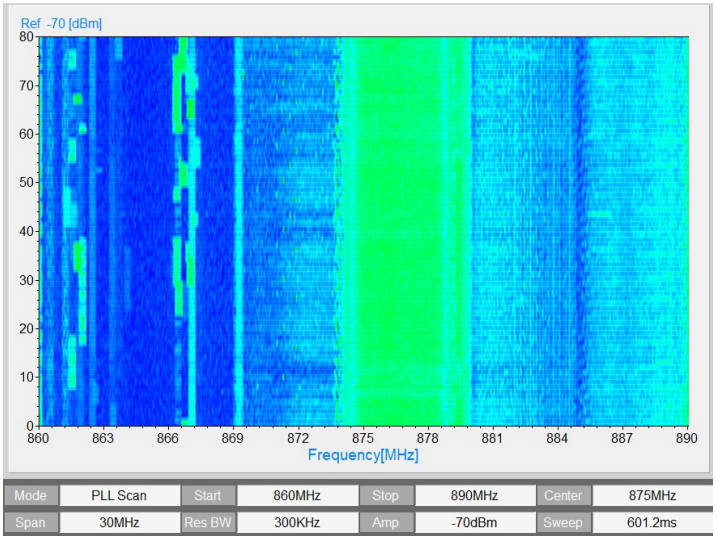
The waterfall display can show the signal spectrum detail with time domain, because normal spectrum waveform will be overlap at time domain. The GSM signal will be good example of waterfall display.



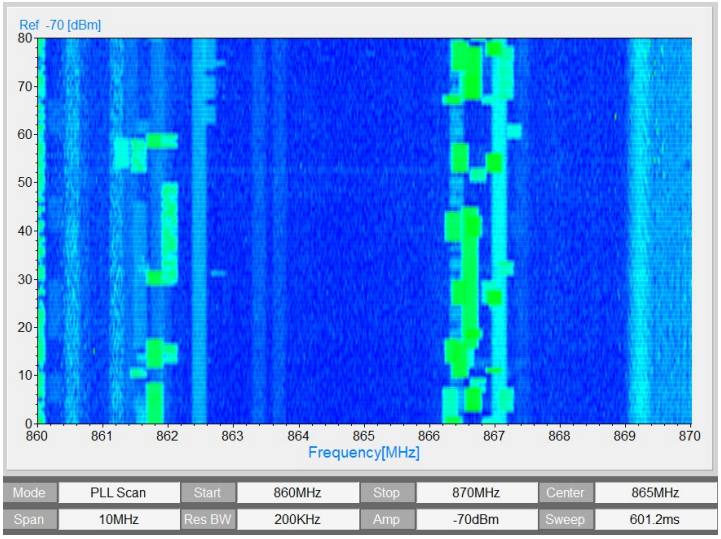
The current display for cell phone BS signal



The density display for cell phone BS signal



The waterfall display for cell phone BS signal



The waterfall display for GSM signal

3.8 Detect Wifi and Bluetooth in the air

The signal of Wifi and Bluetooth are burst signal, they are always jump with time variation. When using current display to show the spectrum of Wifi or Bluetooth, it may be several irregular of pulse signal, so that the display can not be shown full picture of signal spectrum. If using the density display to show the Wifi signal, it will be shown the total spectrum waveform, and also it can be shown the overlap signal. The fast sweep time will be better for density display, for the PLL scan mode, it will be better to set SPAN between 50MHz to 190MHz.

Bluetooth is frequency hopping, waterfall display will be better to show how the Bluetooth is working.

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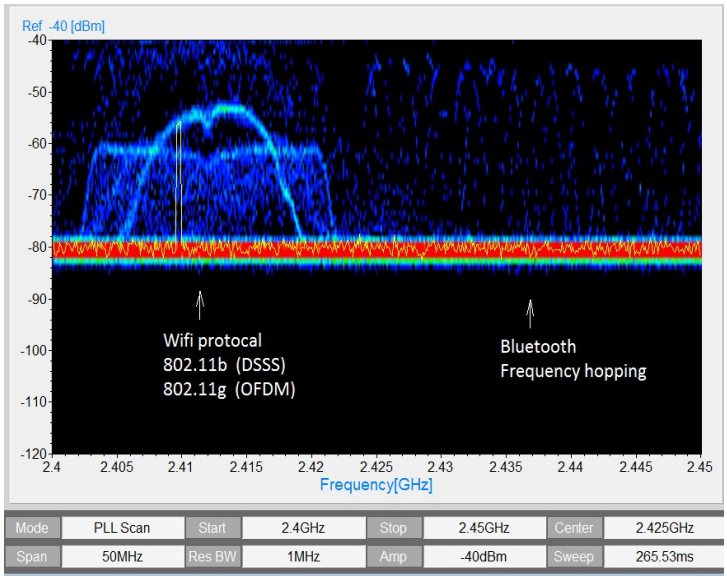
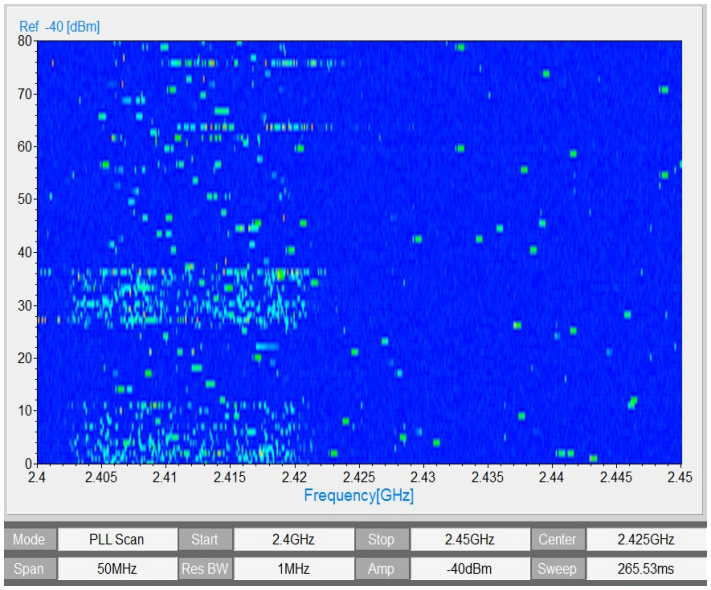


Density display for Wifi channel and Bluetooth



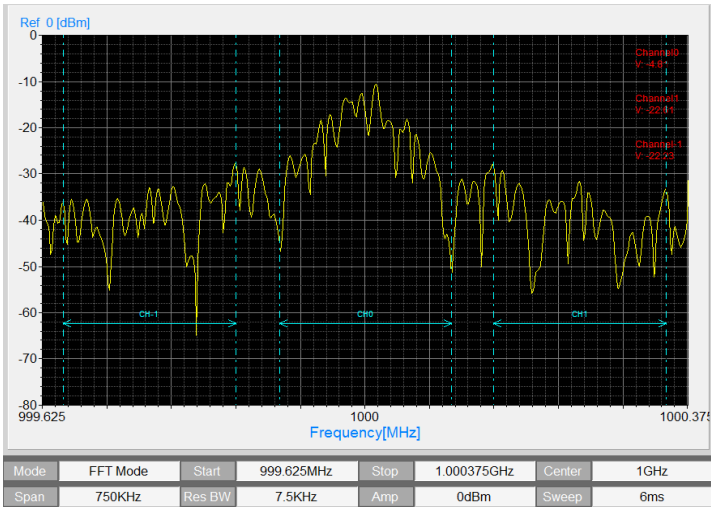
Waterfall display for Wifi channel and Bluetooth

3.9 Channel power measurement

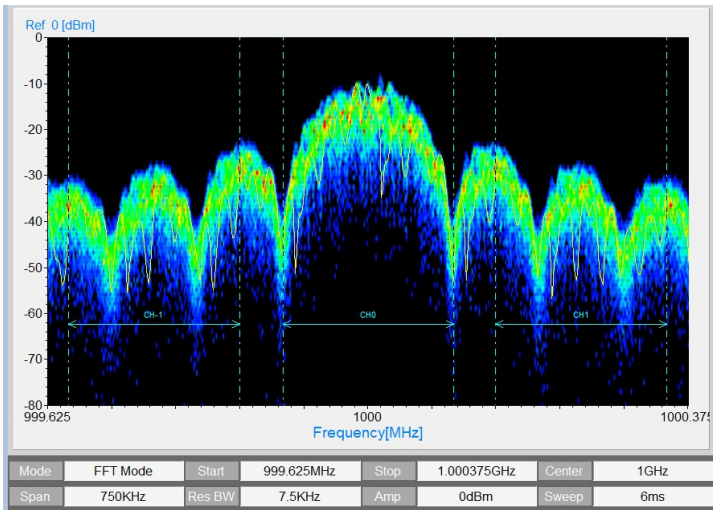
If the signal bandwidth is larger than setup RBW, the spectrum peak level will not represent signal power, it need to use Channel power to measure the signal power.

The VSA channel power function will be easy to measure the signal power, just setup signal space and band width to proper the value, then signal power can be automatic measured, please make sure the signal is located at center point.

The following example is measuring the channel power of QPSK RF signal, the data rate of QPSK modulation signal is 100Kb/s. Setup signal space at 200KHz, and band width is 250KHz. The main channel power is -4.8dBm. The adjacent channel is -22.61dBm and -22.23dBm.



Channel power measurement



Using density display to check the channel power parameter setup

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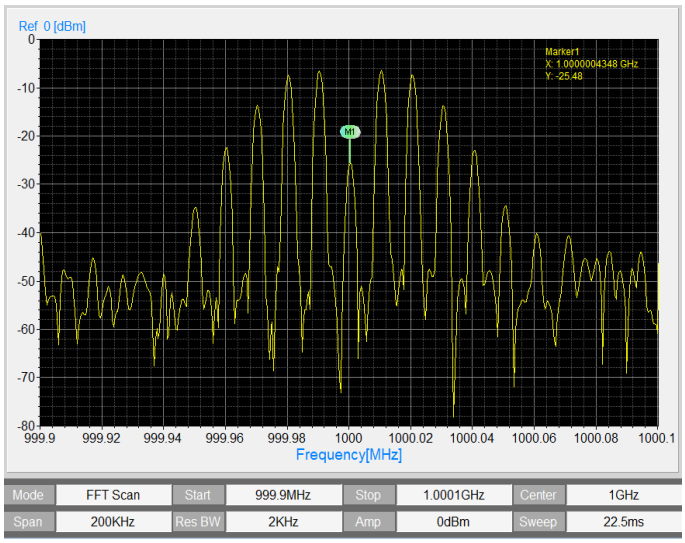
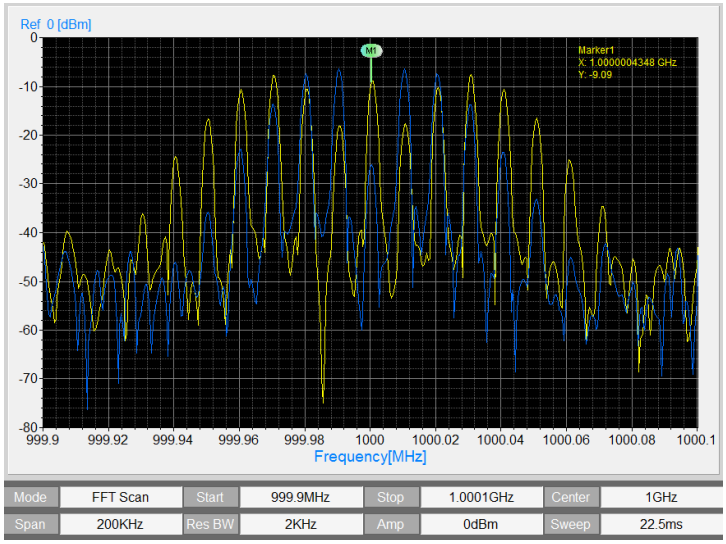
3.10 Reference image

The reference image function is used for comparing of spectrum waveform. It need to first setup spectrum measurement, then copy this spectrum image as reference at Reference menu. The reference image is in blue color.

Following image is reference example, the reference image is FM signal with index =3, the measured spectrum image is FM signal with index=5. Two image are shown together, then user can analyze the difference of FM spectrum with the Index changing.



FM index=3, change into reference at next image



Reference image FM index=3, current image FM Index=5

3.11 Limit line function

The limit line function will be used in product line for testing at manufacture. Setup low and up limit line by file, the file can be easy to build by CSV file, one item is only digital plus comma, it can be 3 items to 501 items.
3 items file will be:

-30,
-5,
-30,

The segment will be defined by connected each points. Each segment will be combine into one limit curve. The limit line curve will be generated by file. When the item number is increased, the more segment will be defined, and curve will be more detail.

When going into the limit line function, it need to turn on up/low limit line, then load file from LimitLine folder. The limit line will be shown at display area in red color.

Select limit line “Pass define” rule, then limit line function will be working, when current waveform is out of limit line, the alarm will be occurred. The red alarm information will be shown at top of display area.

Limit line Reset will resume the limit line to work again.

Alarm Sound will setup PC to make voice tone when alarm is occurred.

Auto Stop/OFF: spectrum analyzer will be still working after alarm is occurred. Auto Stop/ON: spectrum analyzer will be stop working after alarm is occurred.

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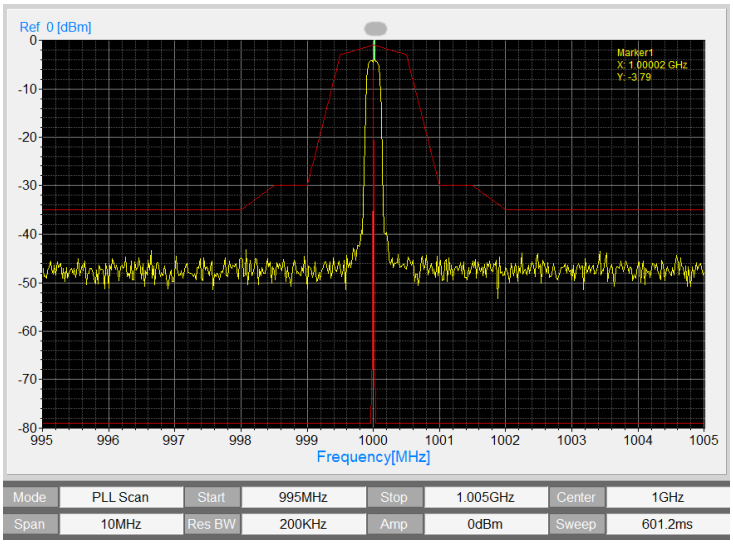
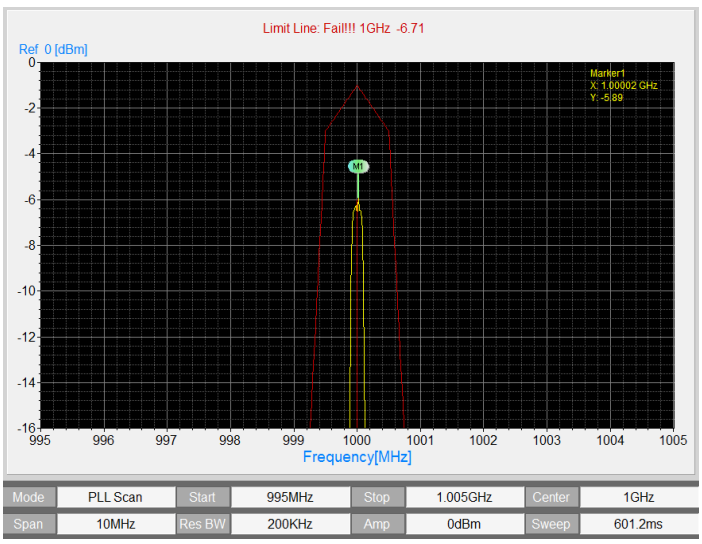


The signal waveform pass the limit line

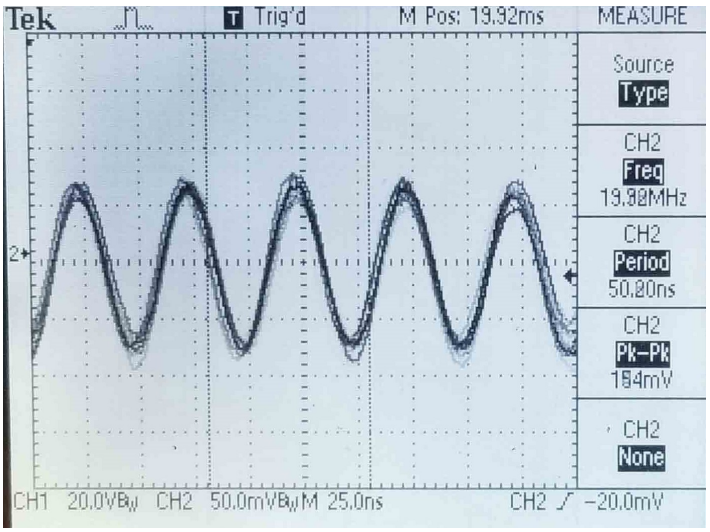


The signal waveform fail the limit line

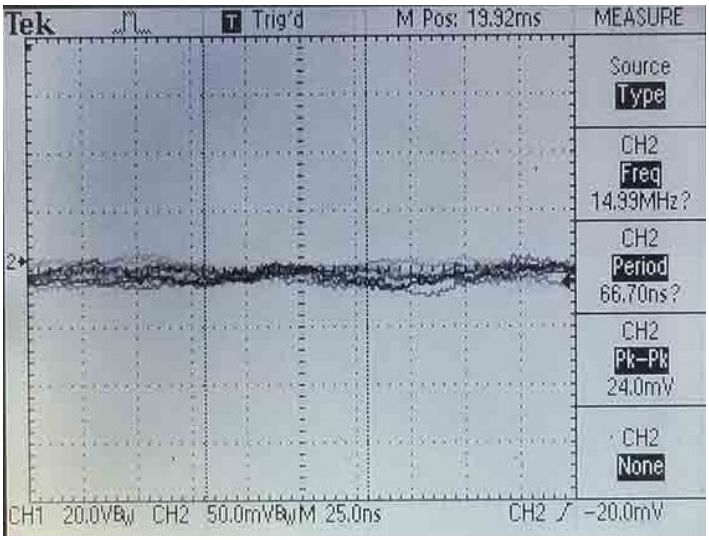
3.12 External I&Q output

The VSA6G2A/B can output I&Q analyzer signal and working as wide band receiver platform. VSA6G2A analog I&Q bandwidth is 4MHz to 40MHz, and VSA6G2B analog I&Q bandwidth is 40MHz to 128MHz. The internal 7 order filter can be set specific LP -3dB corner frequency.

The following example is shown the LP function, setup I&Q output modulation frequency at 20MHz, first image is shown that LP corner frequency set at 21MHz. The 20MHz modulation signal be can output. The second image is shown that LP corner frequency set at 10MHz, so that 20MHz modulation can not pass the filter and removed.



I&Q output when LP corner frequency set at 21MHz



I&Q output when LP corner frequency set at 10MHz

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3.13 Trigger function

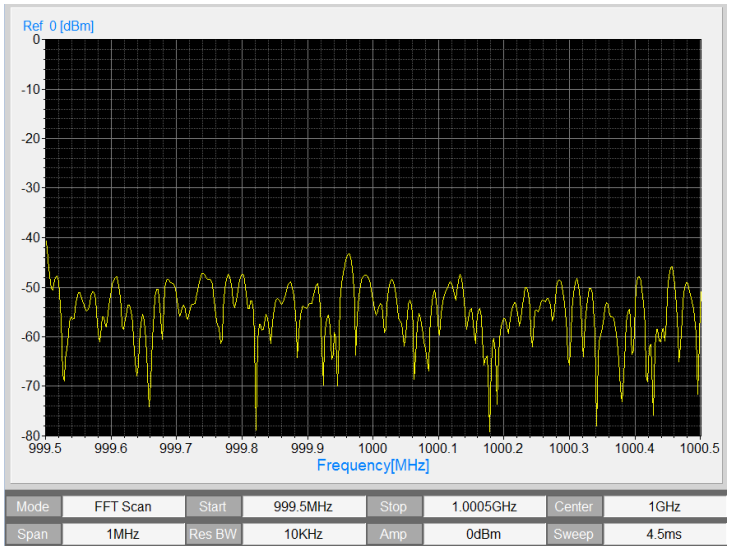
When RF signal is under pulse modulation, it is not easy to display the prefect signal spectrum.

When using trigger function, it is overcome this kind of issue. But it need trigger signal which will be synchronize with RF signal envelop.

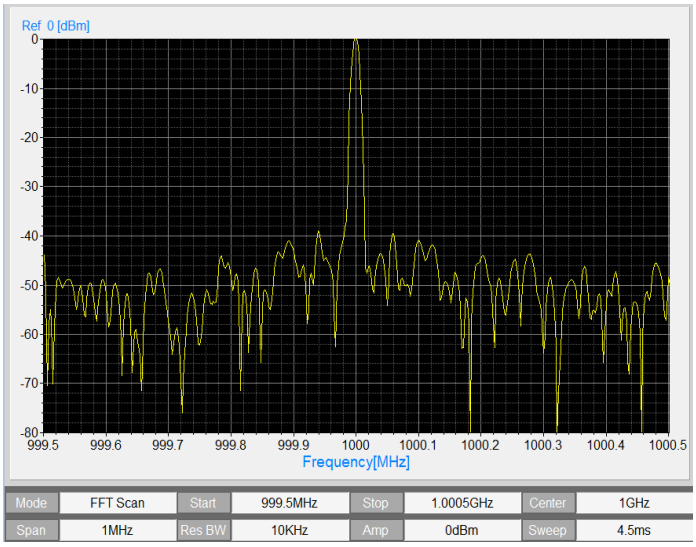
The following example is shown the trigger function, the RF signal generator is VSG6G1, it generate 1GHz RF signal with pulse modulation, the duty cycle is 1/1000 (1ms on and 999ms off).

First image is shown waveform with Trigger OFF. It looks like noise, not any signal.

The second image is shown waveform with Trigger ON, and hardware trigger cable is connected. The waveform looks like normal 1GHz spectrum signal.



Pulse modulation signal when Trigger is OFF



Pulse modulation signal when Trigger is ON, and trigger cable connection.

3.14 Analog Demodulation

Setup RF signal with FM modulation, modulation frequency is 1KHz, frequency deviation is 5KHz, RF frequency is 1GHz.

First, using VSG6G2A/G to measure the spectrum waveform, then select FM ON at Analog Demod key.

Go into Demod setup menu:

Select Chart Name from IQRawData to DemodData, the FM demodulation wave is displayed.

Input RF frequency value, if frequency is not matching with input RF signal.

Set X axial value (ms/DIV) to match with the demodulation frequency.

FramePeriod is reserved for eye diagram function.

Axial DIV can be changed when go into Set Axis.

The first image is shown the FM demodulation feature, Y axial value is shown the FM deviation value.

Change the FM parameter to:

modulation frequency is 5KHz, frequency deviation is 90KHz, RF frequency is 1GHz.

Then turn ms/DIV to 200us. The FM demodulation waveform is shown on second image.

For FM demodulation measurement, it only need to setup two parameter:

1: Certer frequency---setup RF frequency

2: ms/Div---setup demodulation frequency

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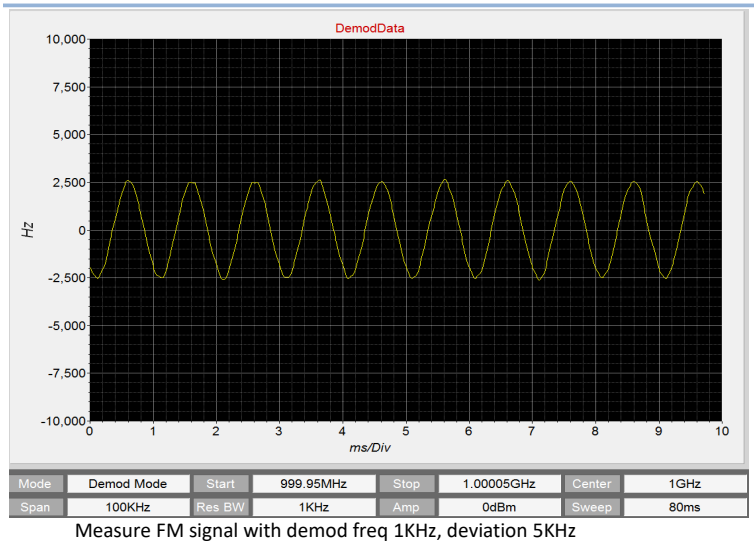
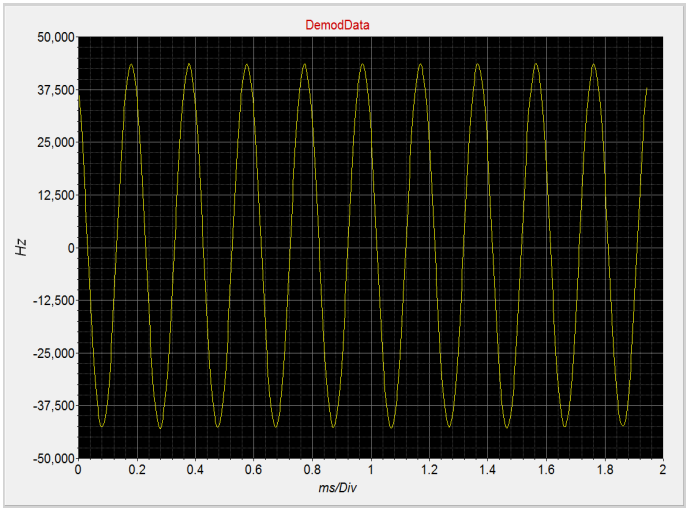


Measure FM signal with demod freq 1KHz, deviation 5KHz

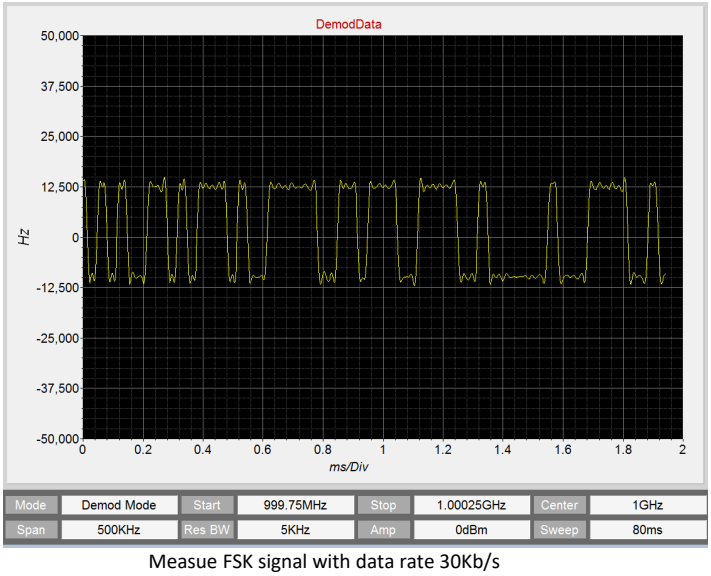


Measure FM signal with demod freq 5KHz, deviation 90KHz

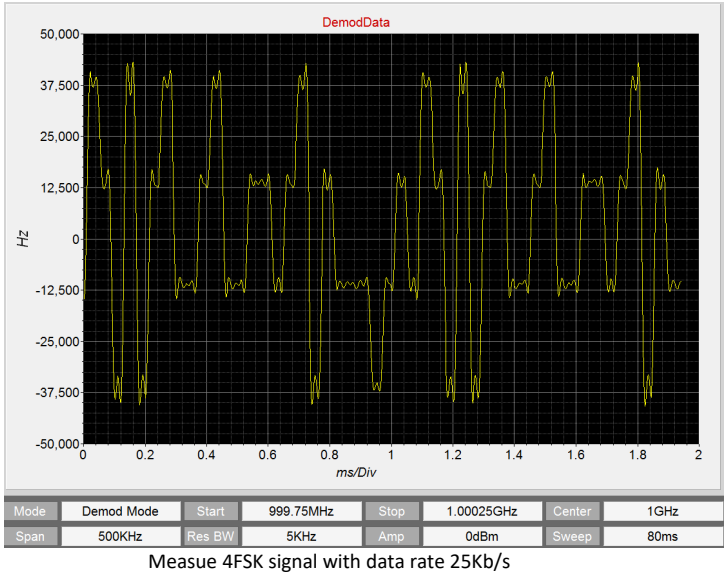
The FM demodulation function also can be used to detect FSK, GFSK, MSK and 4FSK signal. Just turn the ms/DIV value to march with proper the data rate.

Set RF signal with FSK modulation, data rate is 30Kb/s, set ms/DIV=200us, the FSK waveform is shown at first image.

Set RF signal with 4FSK modulation, data rate is 25Kb/s, set ms/DIV=200us, the 4FSK waveform is shown at second image.



Measue FSK signal with data rate 30Kb/s



Measue 4FSK signal with data rate 25Kb/s

Setup RF signal with AM modulation, modulation frequency is 1KHz, index is 50%, RF frequency is 1GHz. Select AM ON at Analog Demod key.

For AM demodulation measurement, it only need to setup two parameter:

1: Certer frequency---setup RF frequency

2: ms/Div---setup demodulation frequency

For AM demodulation frequency at 1KHz, ms/DIV can set at 1ms, AM demodulation waveform is shown at first image.

AM Modulation function also can be used as to detect ASK, OOK signal.

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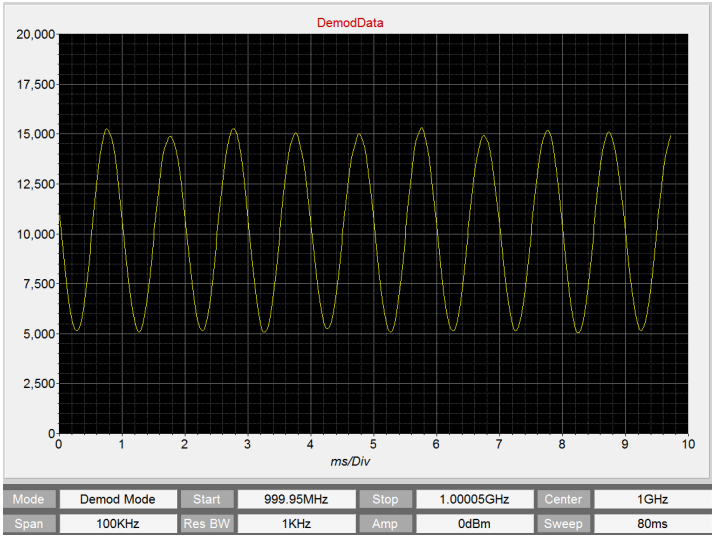
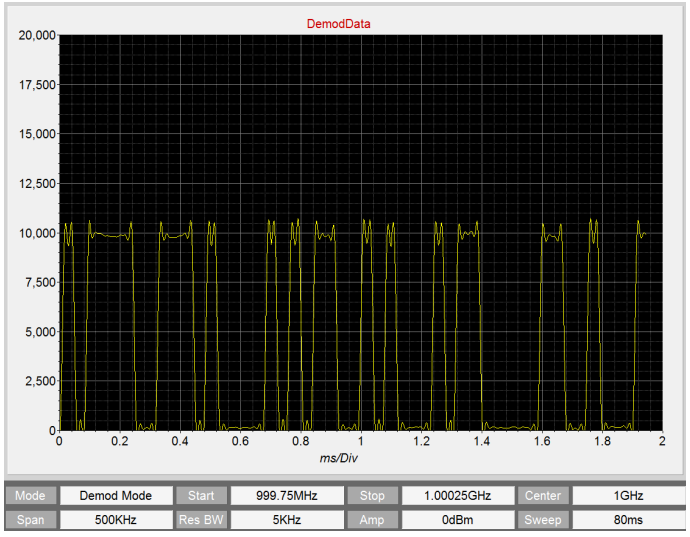
Setup ASK signal with data rate 25Kb/s, ms/DIV can set at 200us, the ASK demodulation waveform is shown at second image



Measure the AM signal with index=50%



Measure the ASK signal with data rate=25KHz

Setup RF signal with PM modulation, modulation frequency is 1KHz, index is 80% (+/-144 degree), RF frequency is 1GHz

It need to setup clock synchronize between the RF signal generator and VSG6G2A

Select PM ON at Analog Demod key.

For PM demodulation measurement, it only need to setup three parameter:

1: Start frequency---setup RF frequency

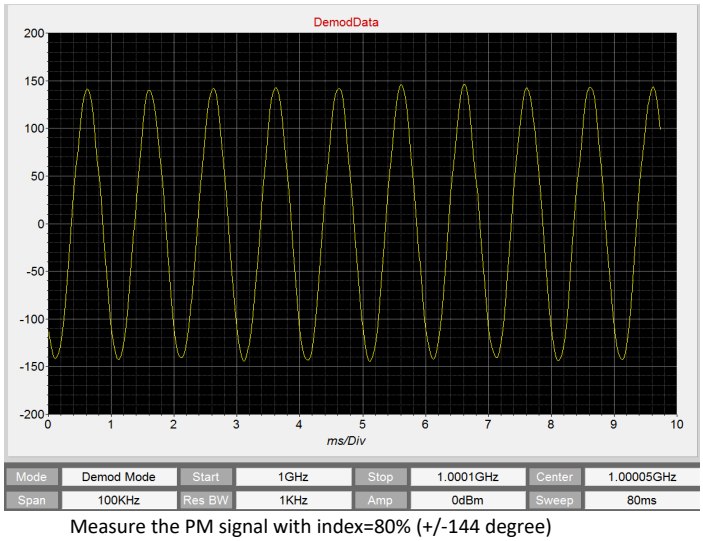
2: IQ Phase--- fine turn the I&Q phase value to make waveform symmetry with 0 degree axial.

3: ms/Div---setup demodulation frequency

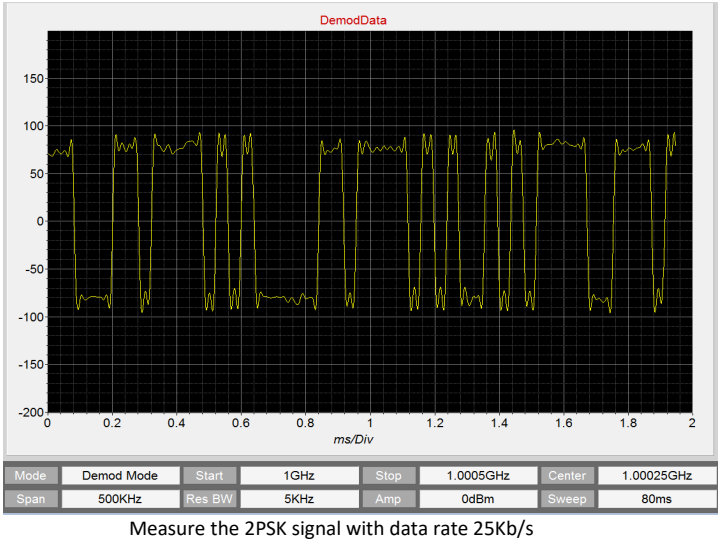
For PM demodulation frequency at 1KHz, ms/DIV can set at 1ms, fine turn the IQ Phase, PM demodulation waveform is shown at first image.

PM Modulation function also can be used as to detect 2PSK, 4PSK, 8PSK.

Setup 2PSK signal with data rate 25Kb/s, ms/DIV can set at 200us, the 2PSK demodulation waveform is shown at second image



Measure the PM signal with index=80% (+/-144 degree)



Measure the 2PSK signal with data rate 25Kb/s

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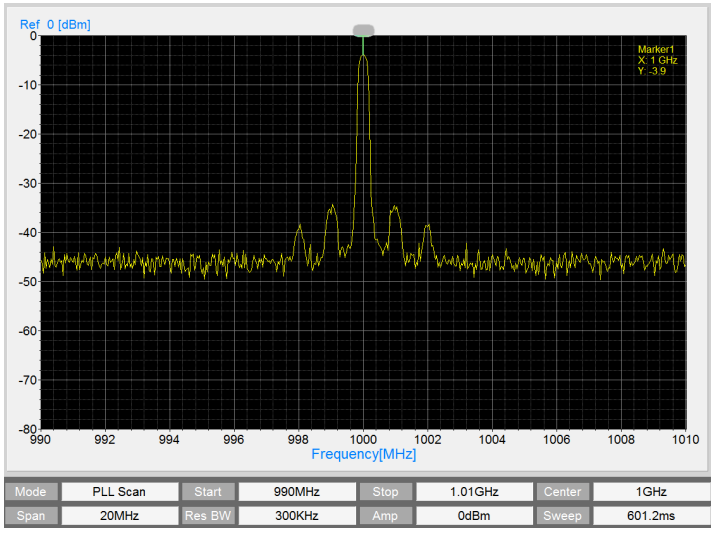
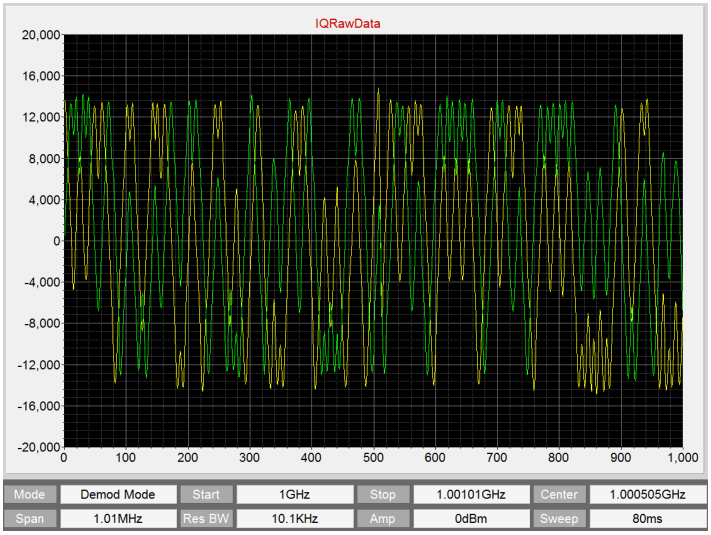
3.15 Digital Demodulation

Setup RF signal with MSK modulation, Symbol rate is 100Kb/s, RF frequency is 1GHz.
It need to setup clock synchronize between the RF signal generator and VSG6G2A
First, using VSG6G2A to measure the spectrum waveform, first image is shown MSK spectrum waveform.
Then select MSK ON at Digital Demod key.
The I&Q RawData waveform is shown at second image



Measure the MSK signal spectrum at PLL scan mode



MSK modulation signal IQ RawData image

Go into Demod setup menu:
select Chart Name from IQRawData to IQ PhaseShift,
Input Frequency value at Start/center frequency key.
Input Symbol rate value at SymbolRate key
SAMP/SYM means how many ADC sample numbers in one symbol, the default value is 10.
Set Auto Phase to ON, the MSK I&Q phase will be automatically adjusted the initial phase to zero.
The I&Q waveform will looks nice comparing to I&Q raw data, the first image is shown waveform of I&Q with phase shift.

After I&Q initial phase shift to zero, Next measurement is be selected.
Select Chart Name to EVM,
The EVM measurement is shown at second image.
The yellow dot is Error value of data point(Verror) , and green line is amplitude of data point (Vref).
EMV=(Verror/Vref)%
The marker will be shown specific point of EMV value.

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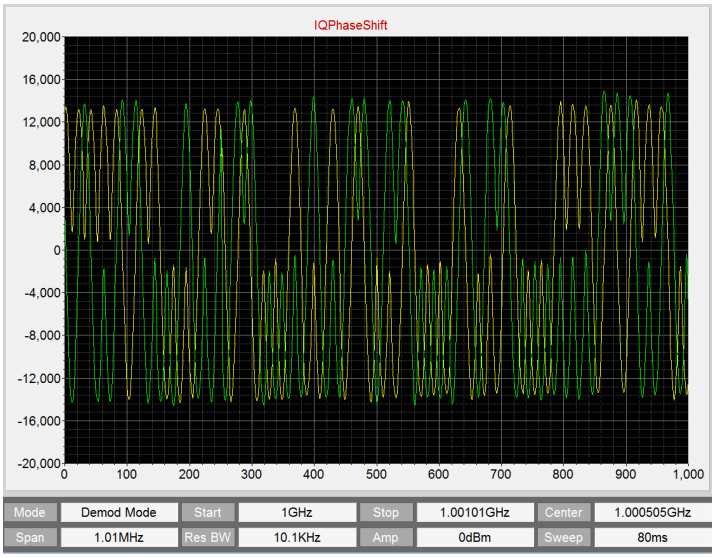
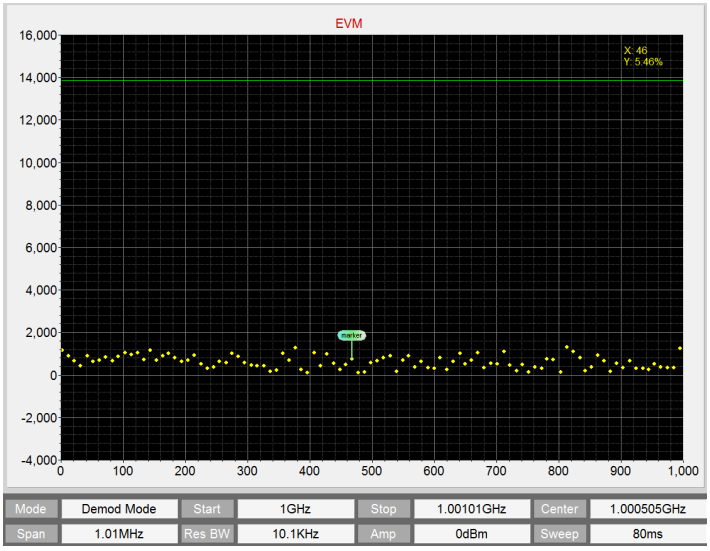
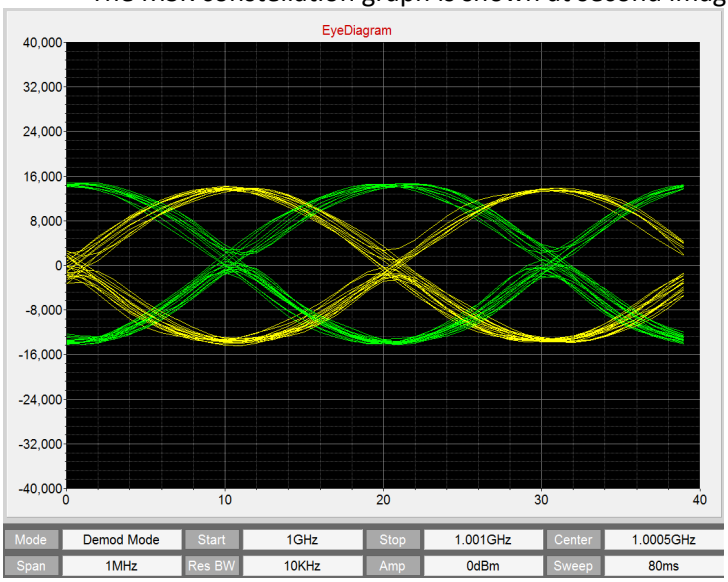


MSK modulation signal I&Q Data with phase shift

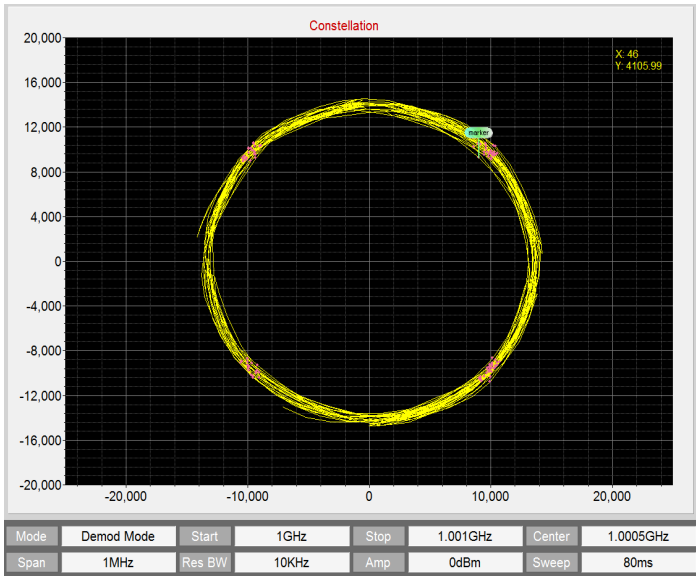


MSK modulation signal EVM measurement

Select Chart Name to EyeDiagram,
The eye diagram of MSK signal will be shown at first image.
If eye diagram is not clear, the symbol rate value can be small changed.
Select Chart Name to Constellation,
The MSK constellation graph is shown at second image.



MSK modulation signal eye diagram



MSK modulation signal constellation

Setup RF signal with 8PSK modulation, Symbol rate is 100Kb/s, RF frequency is 1GHz.
It need to setup clock synchronize between the RF signal generator and VSG6G2A
Then select 8PSK ON at phase Demod key.
Set parameter at Demod setup key which are frequency, symbol rate, samples/symbol, Auto Phase=ON
Select Chart Name from IQRawData to IQ PhaseShift,
The waveform of I&Q Data with phase shift is shown at first image.

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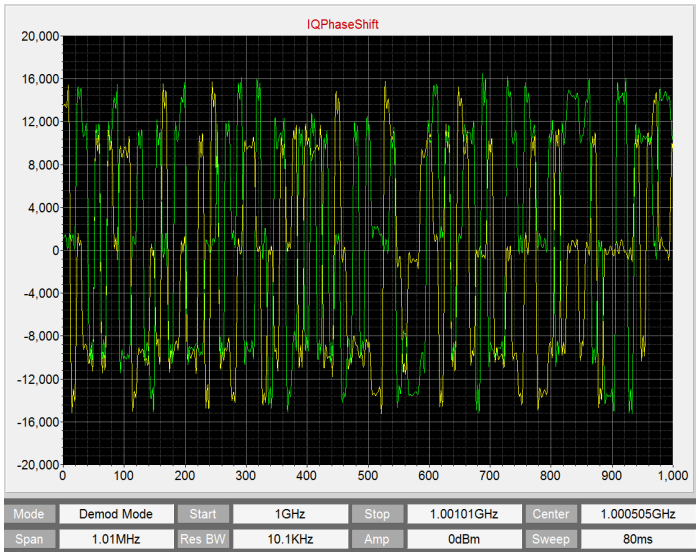
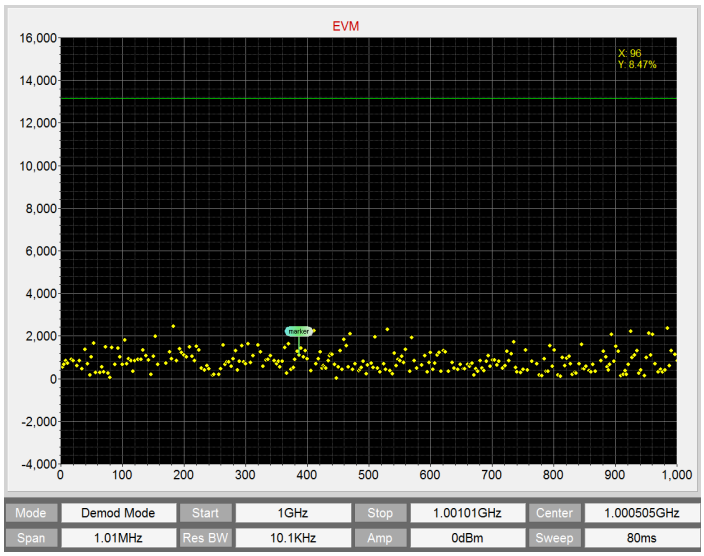
Select Chart Name to EVM, the EVM measurement is shown at second image.

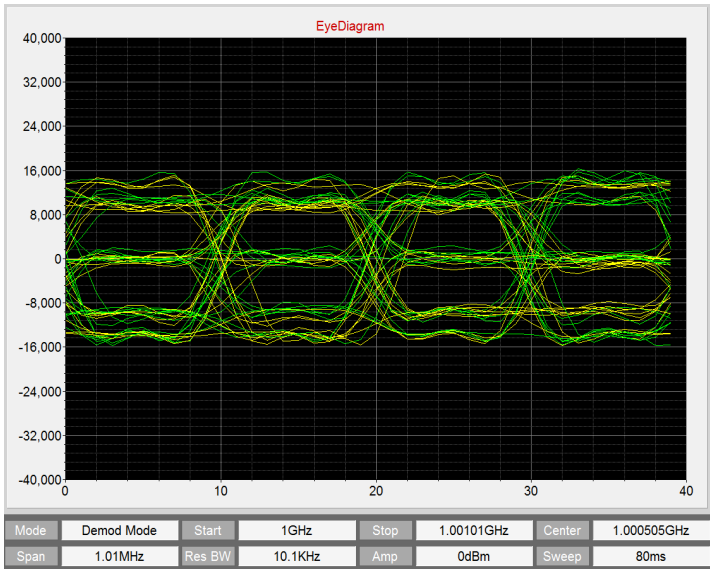


8PSK modulation signal I&Q Data with phase shift

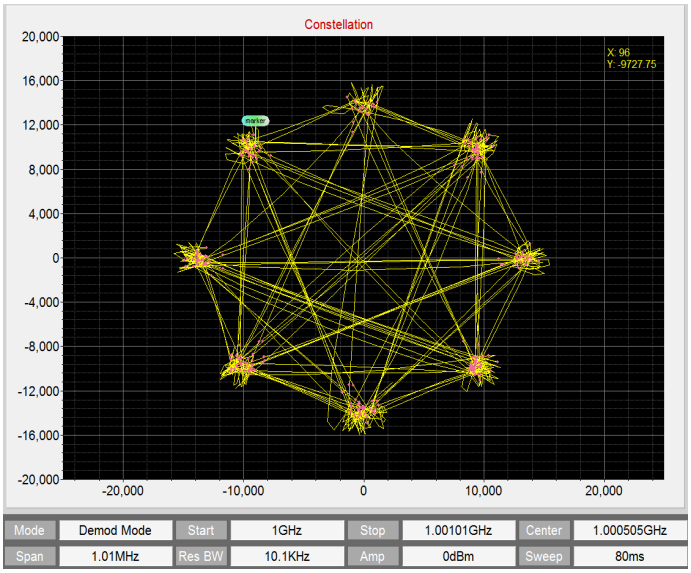


8PSK modulation signal EVM measurement

Select Chart Name to EyeDiagram,
The eye diagram of 8PSK signal will be shown at first image.
Select Chart Name to Constellation,
The 8PSK constellation graph is shown at second image.



8PSK modulation signal eye diagram



8PSK modulation signal constellation