SIGLENT TECHNOLOGIES

Every Bench. Every Engineer. Every Day.

SIGLENT®

Accuracy and Range Extended

SSG6000A

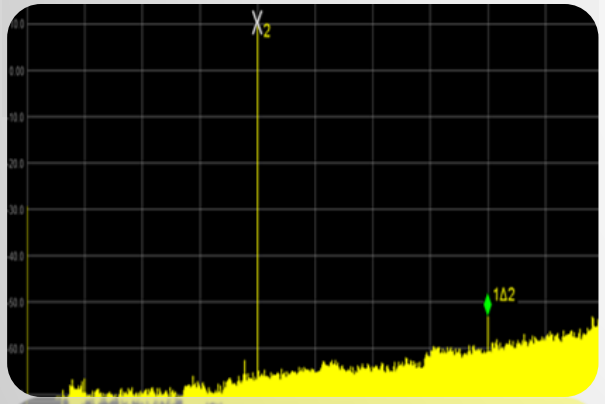
RF signal generator

- Frequency up to 40 GHz
- Outstanding phase noise
  < -135 dBc/Hz

Highlights

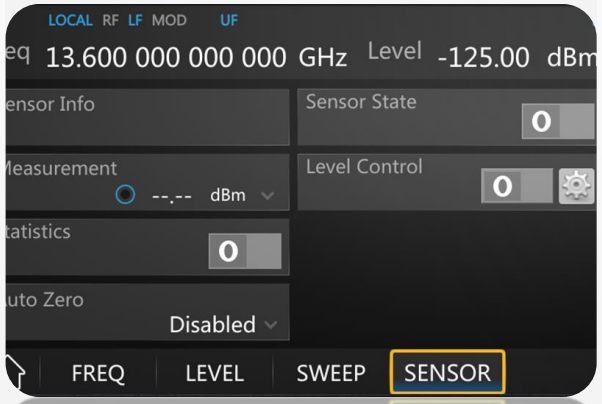
Excellent Signal Purity

- Excellent SSB phase noise
- Low harmonic signal
- Low nonharmonic signal
- Ultra low broadband noise
- Exceptionally high output level
- ...



Exceptional Functionality

- AM Modulation
- Pulse Generator
- Pulse Modulation
- Pulse Train Generator
- Power Meter Control Kit
- ...



Exquisite Design

- Remote control
- Compact structure
- User friendly interface
- Large operating screen
- Rich communication interface
- ...

CONTENTS

PART ONE

01

Brief Introduction

Instrument Tour / User friendly in every detail

SIGLENT's RF Signal Source Technology Roadmap

SSG3000X

Frequency up to 2.1/3.2 GHz

SSB Phase noise < -110 dBc/Hz

……

SSG5000X

Frequency up to 4/6 GHz

SSB Phase noise < -120 dBc/Hz

……

SSG5000A

Frequency up to 13.6/20 GHz

SSB Phase noise < -120 dBc/Hz

……

SSG6000A

Frequency up to 13.6/20/**40 GHz**

SSB Phase noise < **-135 dBc/Hz**

……

More

Future plans up to a frequency of **67 GHz**

……

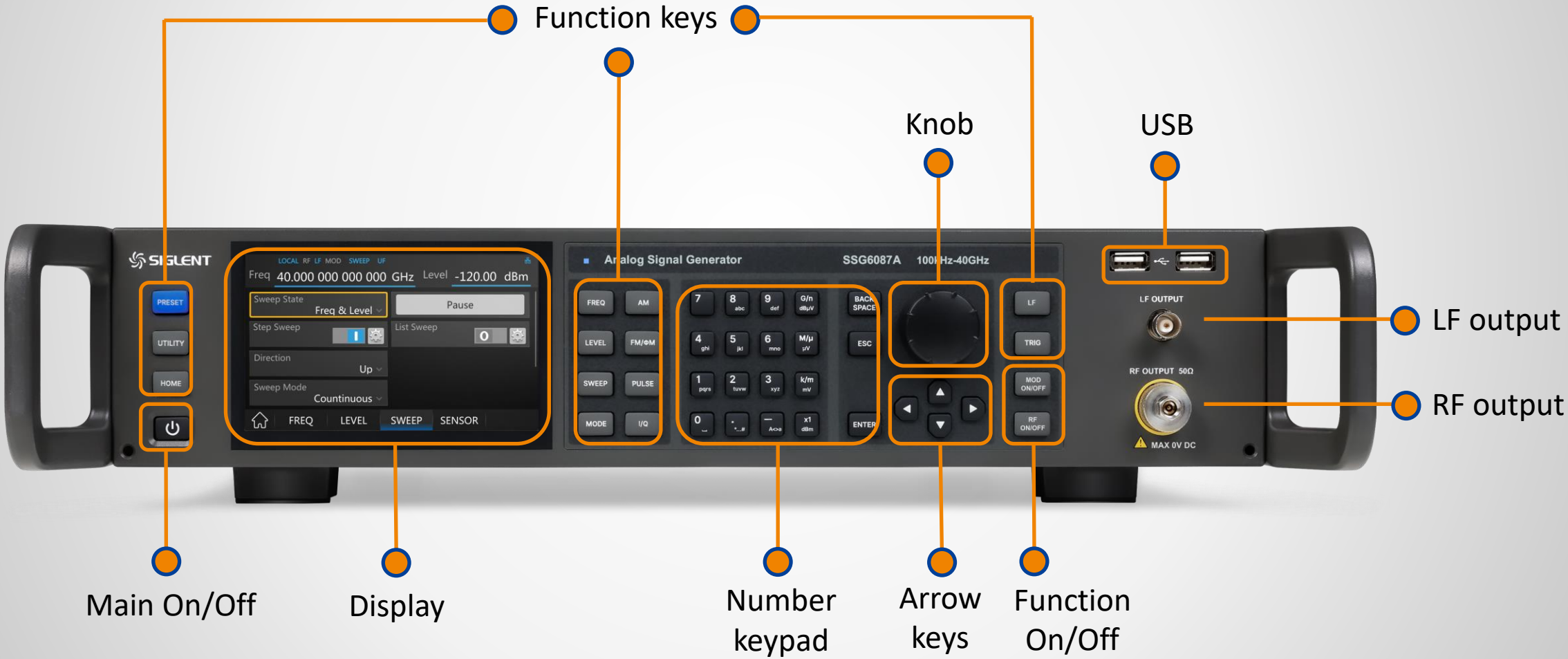
SSG6000A Series

RF Signal Generator

Models	SSG6083A	SSG6085A	SSG6087A
Frequency Range	CW MODE 100 kHz-13.6 GHz	CW MODE 100 kHz-20 GHz	CW MODE 100 kHz-40 GHz
Level setting range	-130 dBm to +24 dBm		
Amplitude Resolution	0.01 dB		
Level Accuracy	≤ 0.7 dB(typ.)		
Phase Noise	-135 dBc/Hz @1 GHz, offset 20 kHz (typ.)		
Display	5 inch capacitance touch screen, RGB (800*480)		

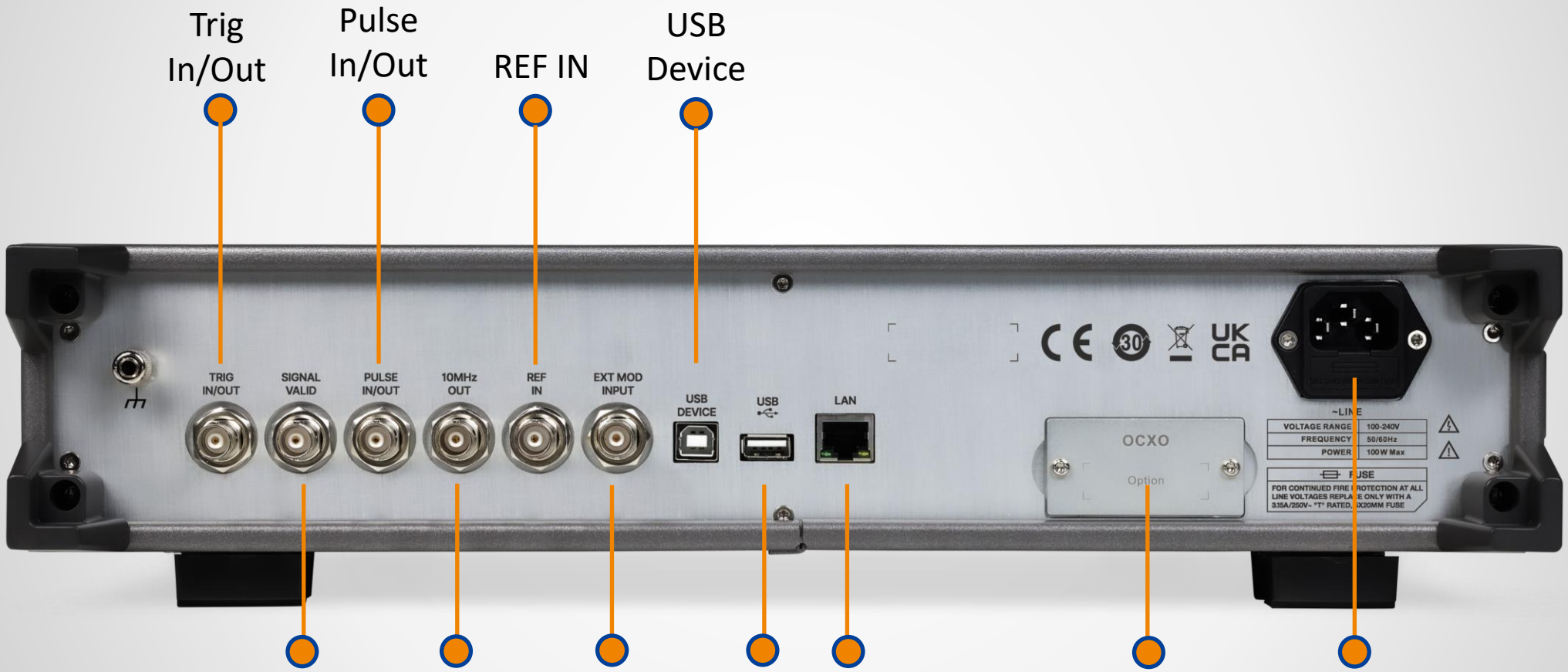
SSG6000A Front Panel Tour

Flexible large screen touch operation



SSG6000A Rear Panel Tour

Multiple control and function extension interfaces



PART TWO

02

Technical Highlights

Performance parameters and specific advantages of SSG6000A

Features and Benefits

Going into details: make operation more fluent

01

User Friendly Interface

- 5" touch screen
- Multiple shortcut keys
- Save occupied space and maintain test accuracy
- Simplify measurement setup steps and improve test efficiency

02

Abundant Communication Interfaces

- Support remote web page control
- Support mouse, keyboard, storage and calibration
- More connection and control modes: flexible and practical

03

Ultra High Output Frequency

- Up to 13.6/20/40 GHz
- Suitable to a wider range of fields, such as radar systems and antenna testing
- Perform basic local oscillator up-conversion or continuous wave blocking test

04

Exceptionally High Output Level

- Attenuation in the test device can be easily compensated
- High-sensitivity receive convenient for testing
- Characterization of broadband MW components

05

Outstanding SSB Phase Noise

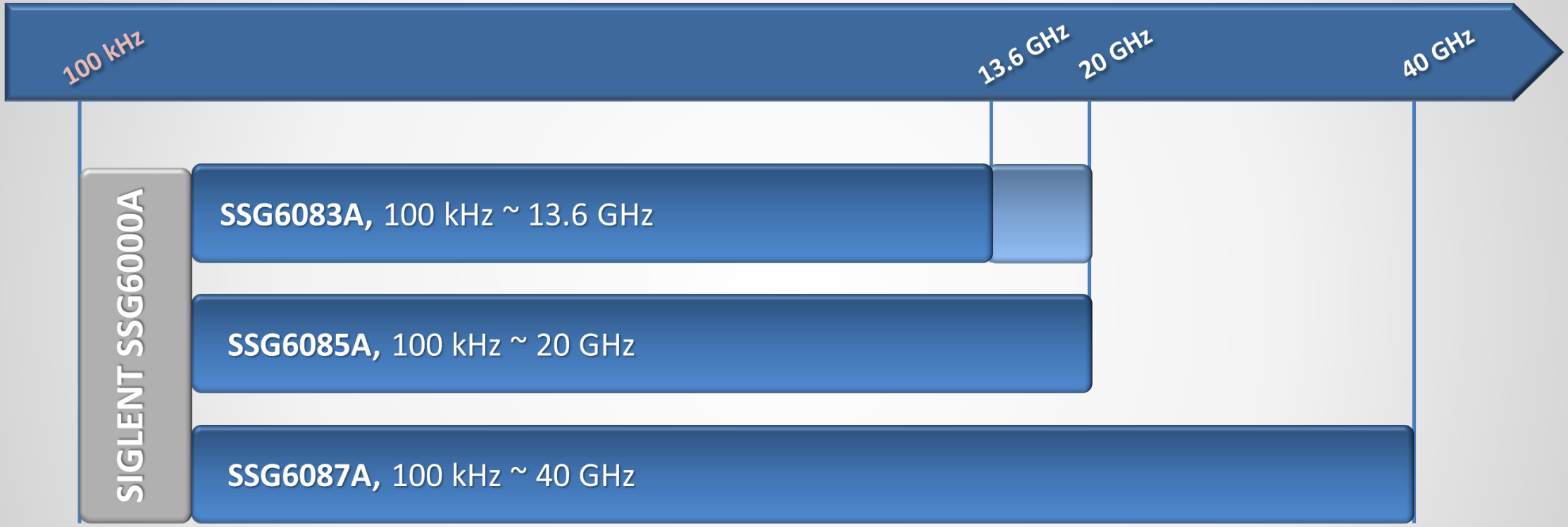
- < -135 dBc/Hz @1 GHz, offset 20 kHz (typ.)
- Improve close-in phase noise
- Very low harmonic signal components over the entire frequency range even at very high output power

06

High Performance OCXO

- High stability
- Pure signal and Pure spectrum
- Excellent level accuracy and repeatability

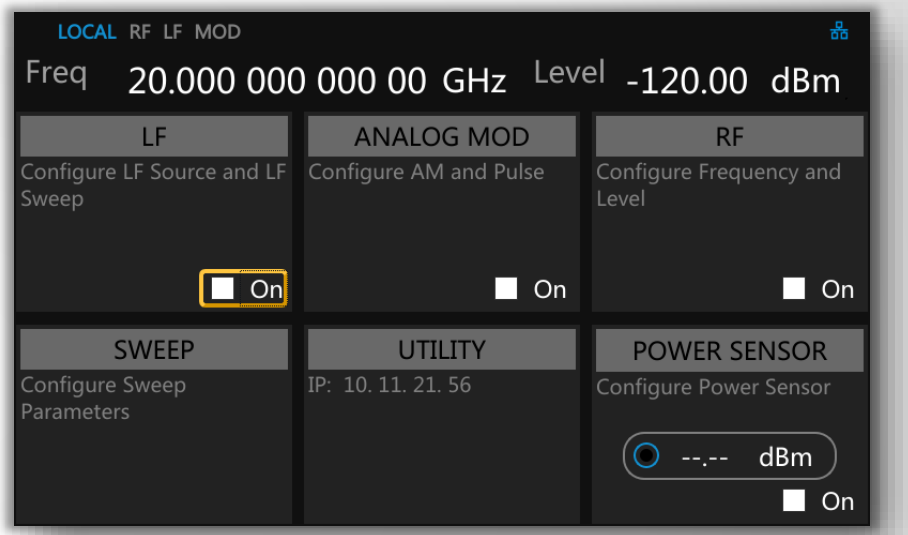
Meet The Test Requirements



- ISM band up to 5.7 GHz
- Blocking characteristics of CW signal up to 12.75 GHz
- Two frequencies up to 20 GHz and up to 40 GHz can cover the microwave frequency range. It is suitable for testing various radar systems in X-band and K-band including testing sensitive broadband receivers

Easy to Navigate & Dependable

- Touch screen, Web Control, and front panel buttons including mouse and keyboard can all be used
- It has high frequency and power stability in the working temperature range of 0~50 ℃
- Long term stability is important in aging and lifecycle tests that can last days or weeks.



Frequency Reference	
Temperature stability	±1 ppb, 0℃ ~50℃
Frequency aging rate	50 ppb/1 year

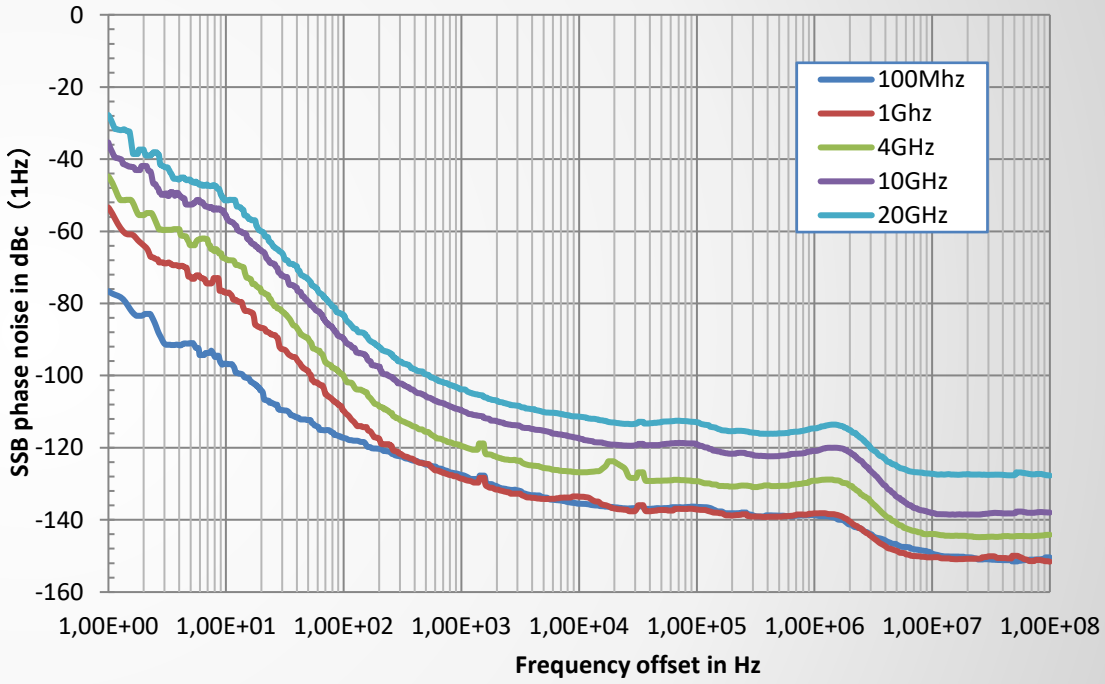
Ultra Fast Switching Speed

- Time is money, faster generators shorten the test time and save manufacturing costs
- How fast does a generator change from one frequency/ amplitude/ waveform to another?
- Main Factors: Type of change, source of commands (SCPI, List/Step Sweep mode)
- When it matters: Tests which require fast change of frequency/ amplitude/ waveforms
  - For example, receiver sensitivity measurements and bit-error-rate (BER) measurements, verify amplifier functionality over variable waveforms, amplifier gain compression tests require various power levels

SSG6000A Frequency and Level Setting Time	
Frequency Setting Time	ALC ON <10 ms
	ALC OFF (S&H) <20 ms
Frequency Sweep Dwell Time	10 ms~100 s
Level Setting Time	ALC ON <10 ms
	ALC OFF (S&H) <20 ms

Excellent Phase Noise

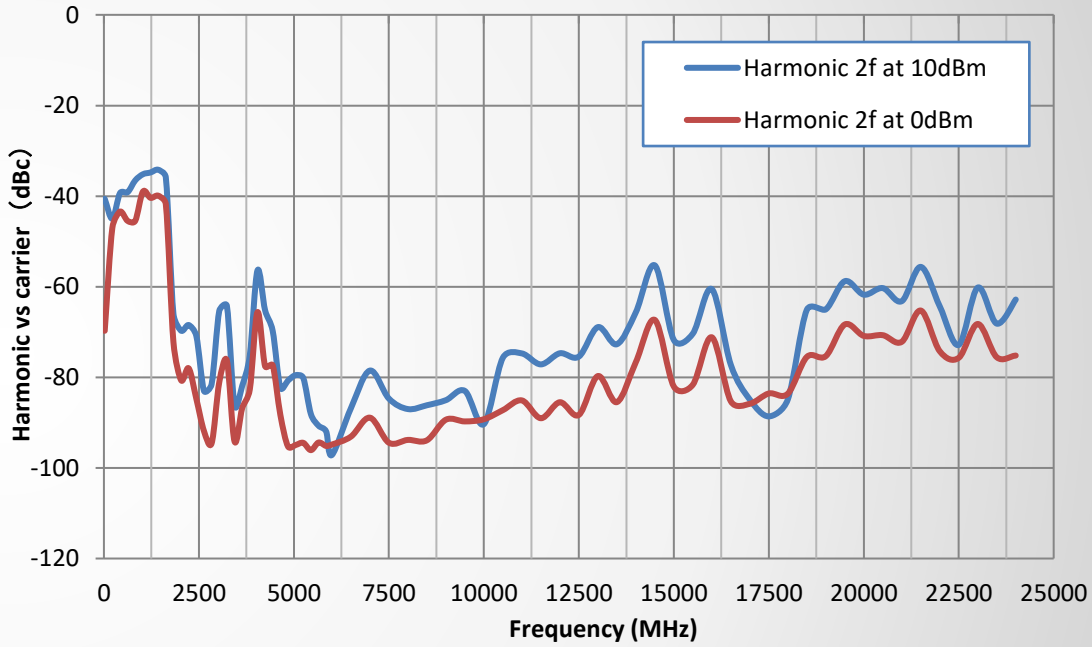
- Excellent phase noise: < –135 dBc/Hz (typ.) for 1 GHz at an offset of 20 kHz
- Ideal choice for local oscillator and low jitter clock replacement
- Meets the harsh challenges of radar module and system testing with ease
- Conduct blockage and adjacent channel selectivity test of high-performance receivers



SSB Phase Noise

Low Harmonic Signal Components

- Very little wideband noise: < –155 dBc (typ.) at 10 GHz and an offset of 10 MHz
- Very low harmonic signal components over the entire frequency range even at very high output power
- Let you no longer be troubled by interference signals when testing components, systems and OTA



Second harmonic versus carrier frequency at level 0 & 10 dBm

Harmonics	
1 MHz < f ≤ 2 GHz	< -30 dBc
2 GHz < f ≤ 4 GHz	< -50 dBc
4 GHz < f ≤ 20 GHz	< -46 dBc

Sub harmonics	
1 MHz < f ≤ 40 GHz	< -80 dBc

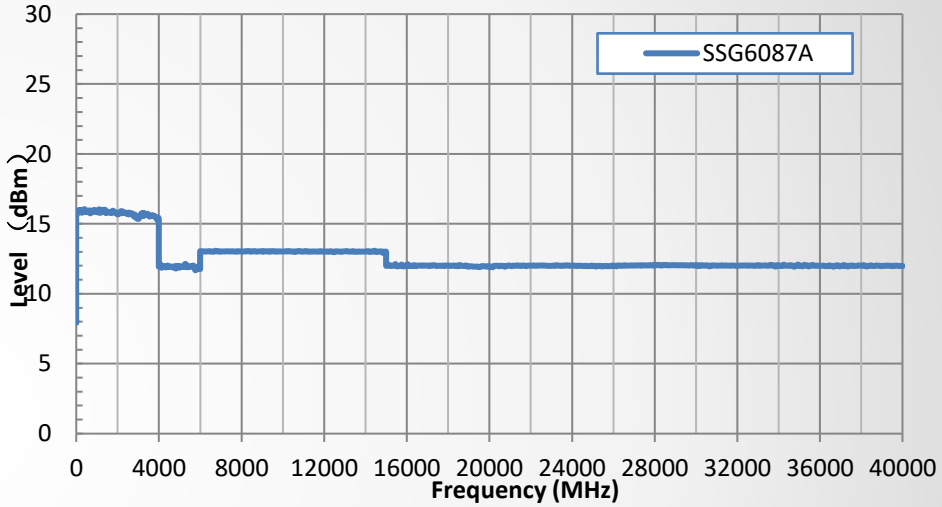
Non-harmonics	
1 MHz < f ≤ 4 GHz	< -60 dBc
4 GHz < f ≤ 40 GHz	< -50 dBc

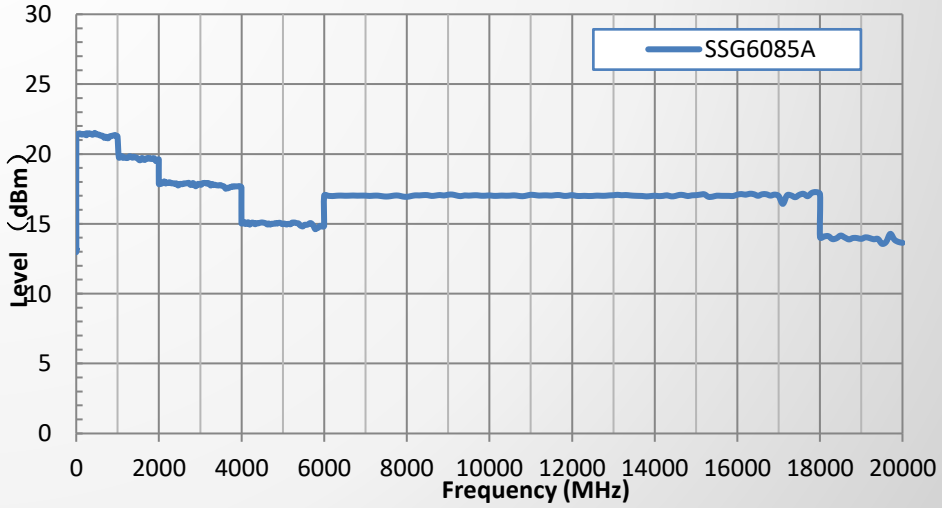
Exceptionally High Output Power

- Ideal choice for high sensitivity receiver testing
- Characterization of broadband microwave components, such as filters and amplifiers
- If you need a high-power excitation signal in the test, you can get the required test signal without an external amplifier, with higher power accuracy and better stability

SSG6087A	
100 kHz ≤ f <3 MHz	8 dBm
3 MHz ≤ f < 4 GHz	16 dBm
4 GHz ≤ f ≤ 6 GHz	12 dBm
6 GHz < f ≤ 15 GHz	12 dBm
15 GHz < f ≤ 20 GHz	12 dBm
20 GHz < f ≤ 40 GHz	12 dBm

SSG6083A & SSG6085A	
100 kHz ≤ f < 3 MHz	13 dBm
3 MHz ≤ f< 1 GHz	22 dBm
1 GHz ≤ f ≤ 2 GHz	20 dBm
2 GHz < f ≤ 4 GHz	18 dBm
4 GHz < f ≤ 6 GHz	15 dBm
6 GHz < f ≤ 18 GHz	17 dBm
18 GHz < f ≤ 20 GHz	14 dBm

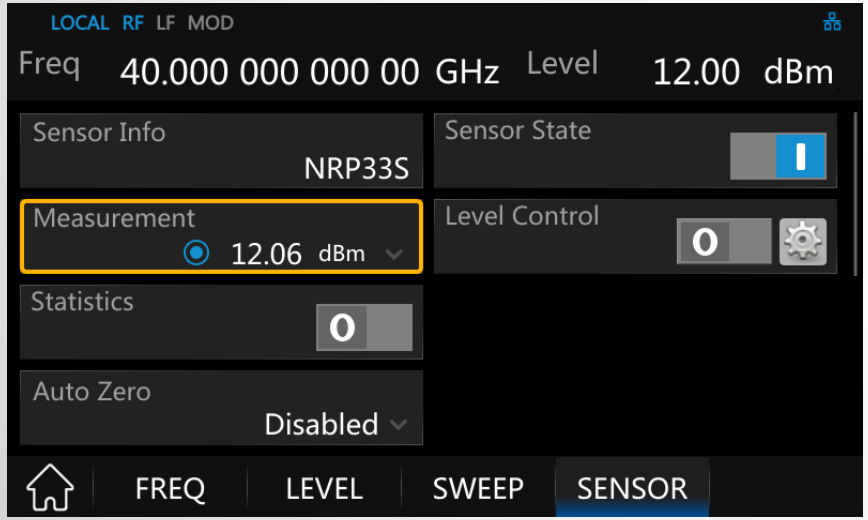




Exceptionally High Output Power

- **Very high output power even in the wide frequency range**

- **No Need To Use External Amplifier**
  - Microwave frequency range usually requires high output power
  - The higher the frequency, the greater the attenuation
  - Different output power levels are provided to compensate for such losses

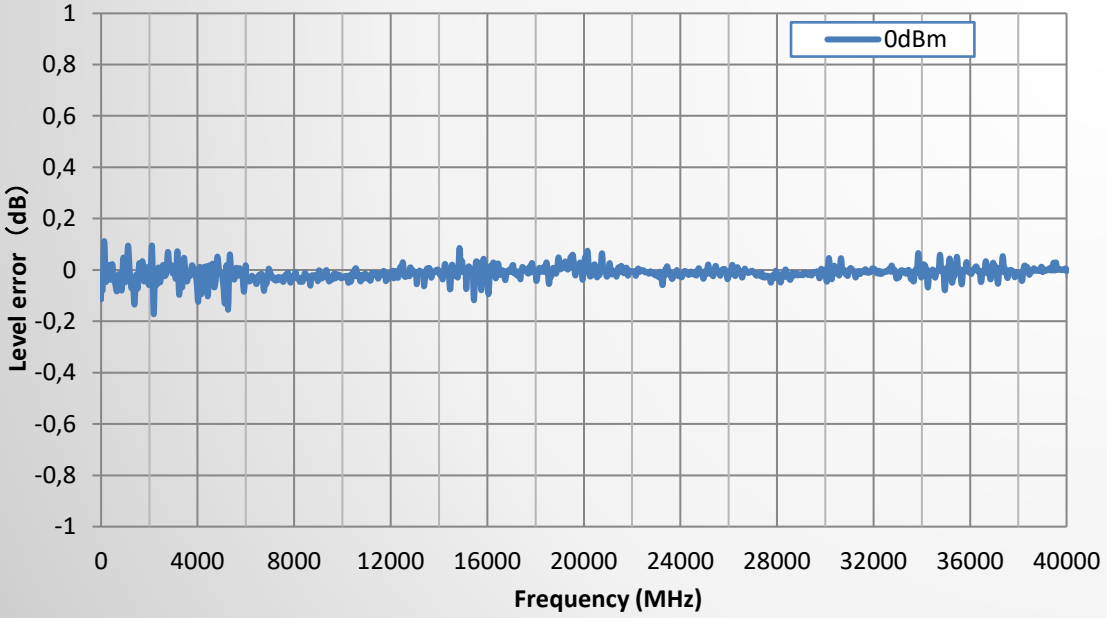


Test the power of SSG6000A with a power sensor

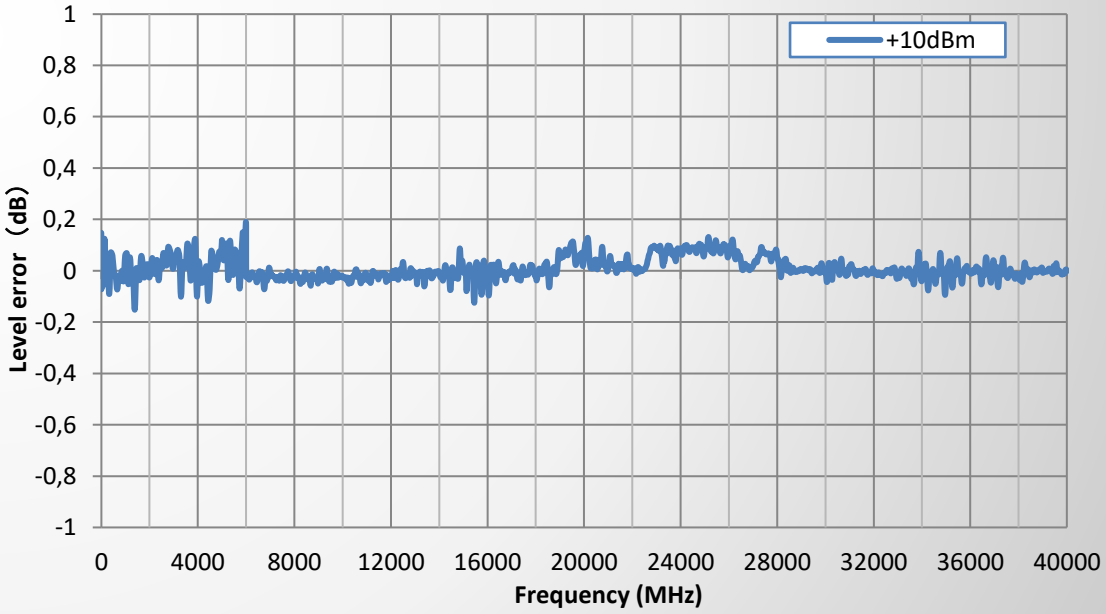
High Absolute Level Accuracy

- A signal generator's absolute level accuracy is just as important as its output power

- Quantitatively characterize the nonlinear performance of an amplifier (1 dB compression point)

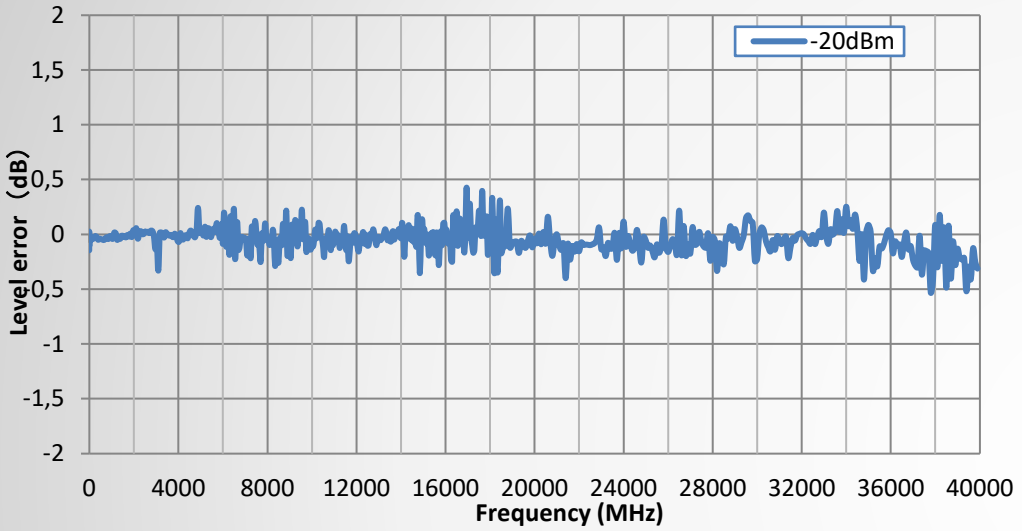


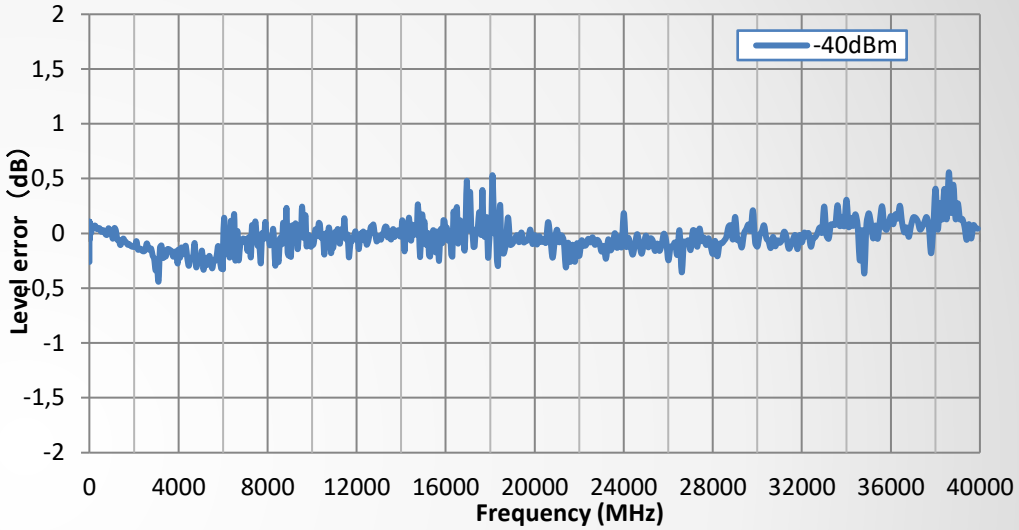
Measured level error versus frequency, Level = 0 dBm

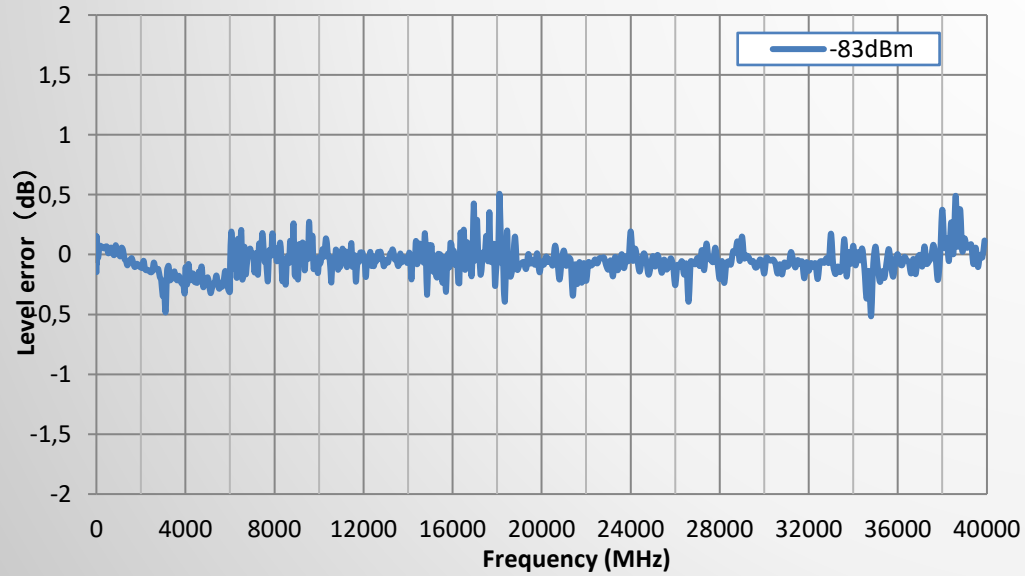


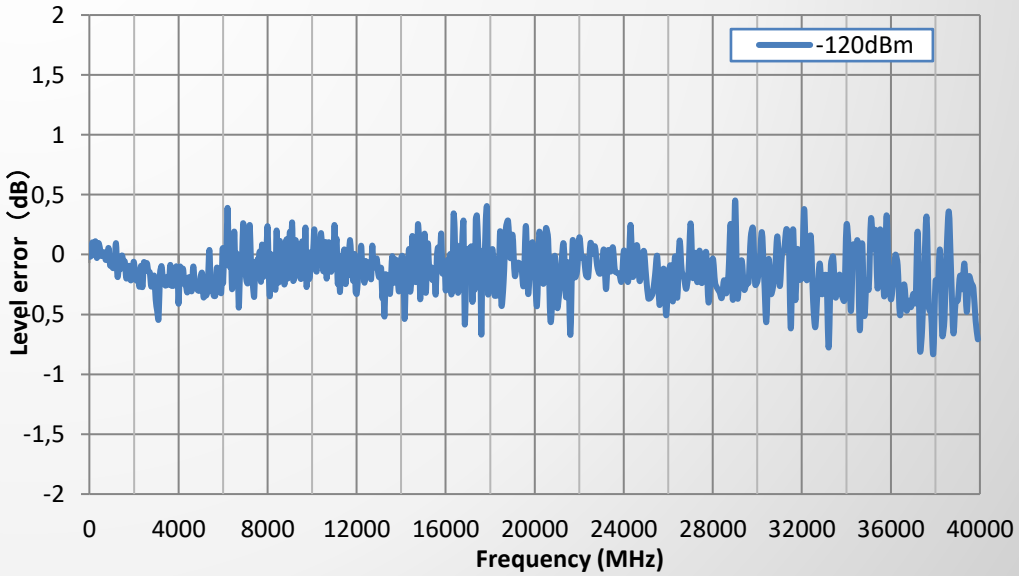
Measured level error versus frequency, Level = 10 dBm

High Absolute Level Accuracy





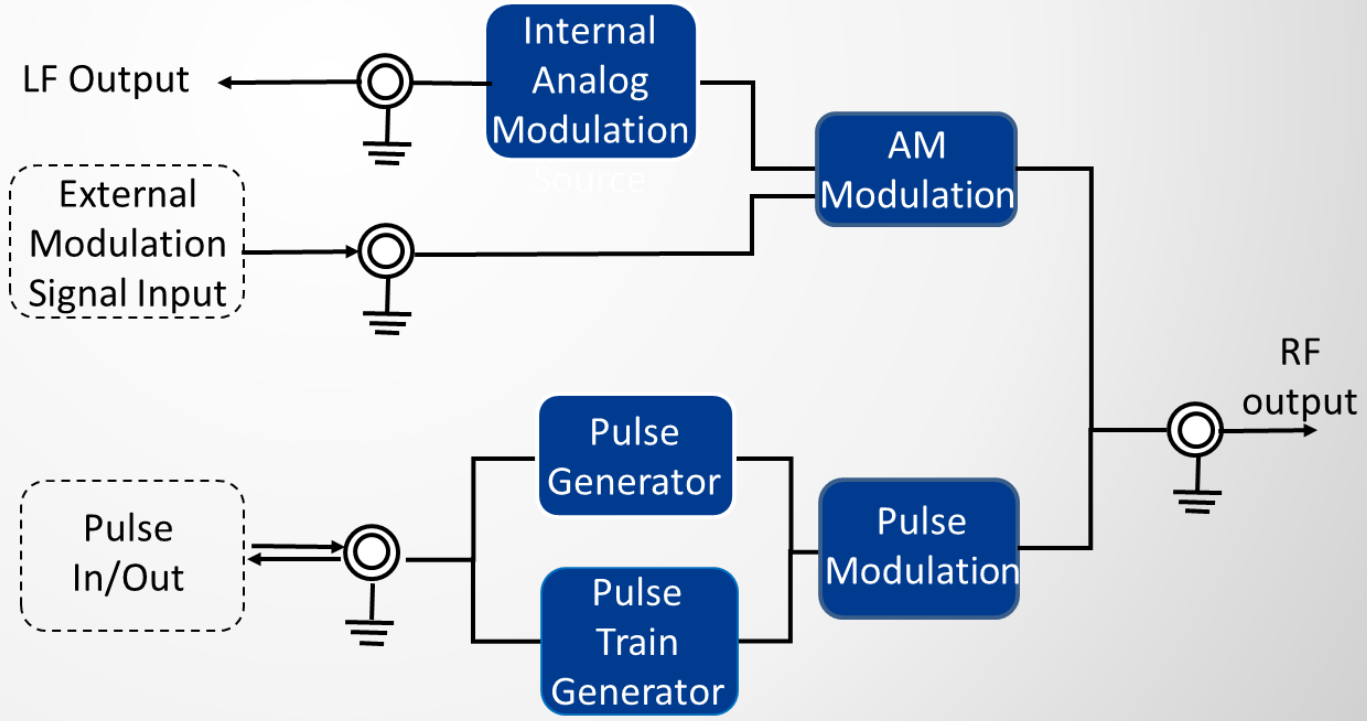




Analog & Pulse Modulation

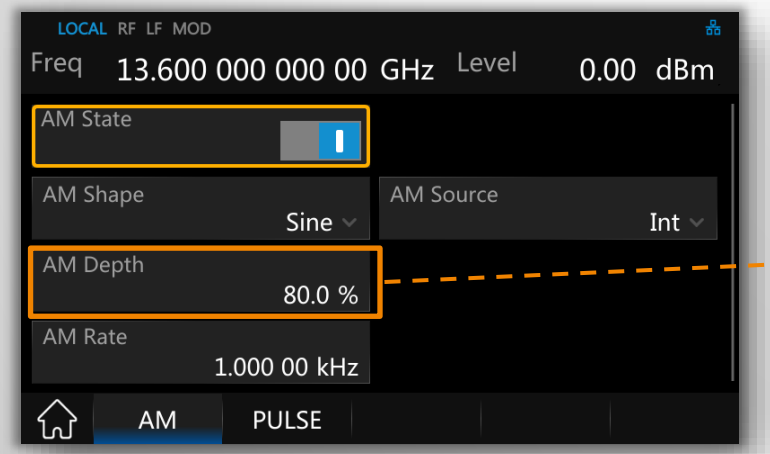
- In addition to continuous wave signals, SSG6000A also provides the most common analog AM modulation mode as a standard configuration

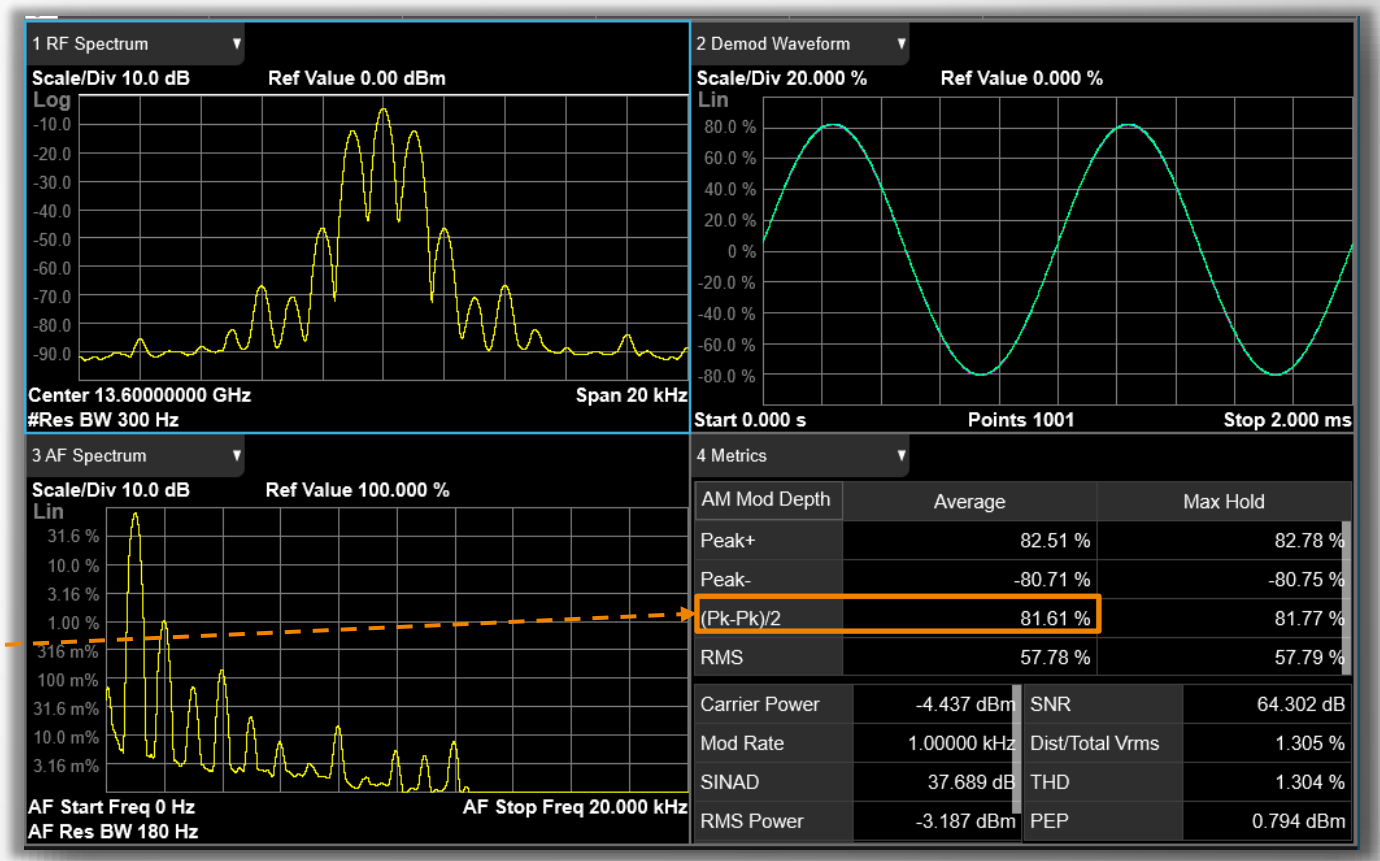
- In addition, SSG6000A is equipped with an excellent pulse signal generator and pulse modulator to generate user-programmable pulses



AM Modulation

- High signal quality and perfect waveform reproduction
- Modulation source:
  internal, external, internal + external

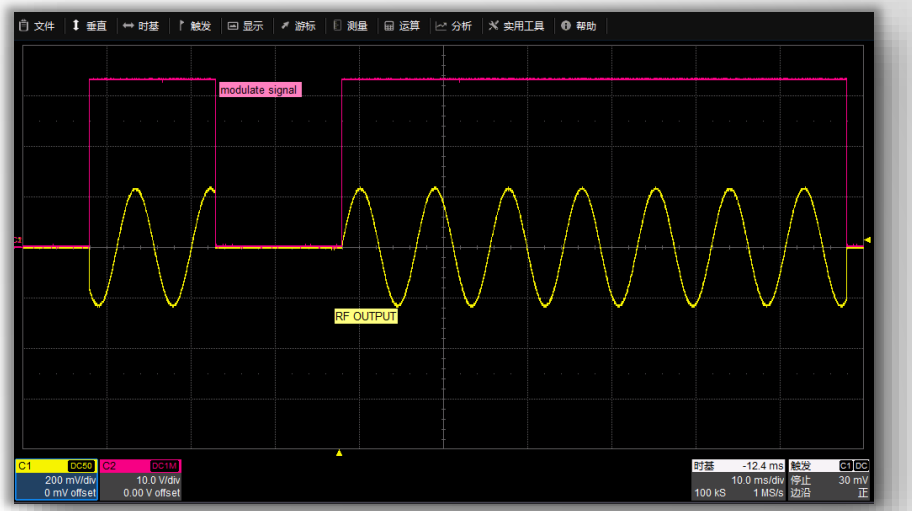




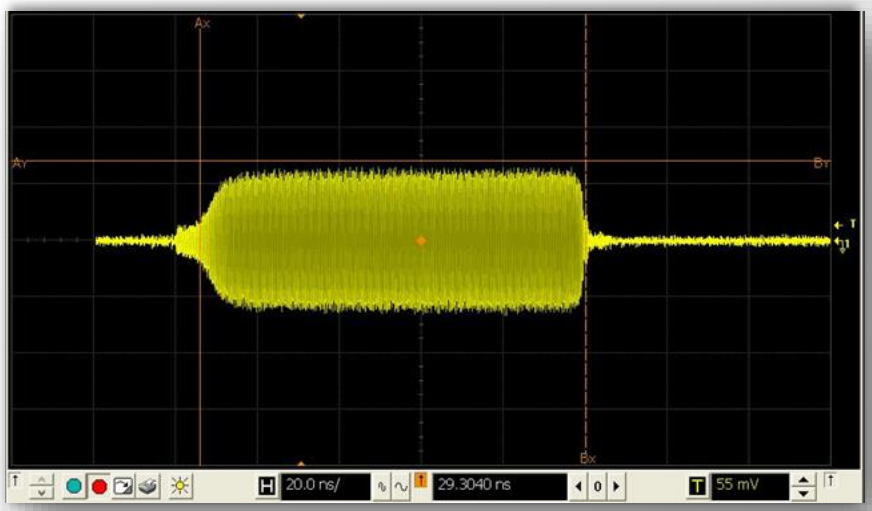
Pulse Modulation (SSG6080A-PU)

- Support double pulse modulation
- Less pulse width loss and extremely low overshoot probability
  - At 6GHz,
    the pulse width of 100ns is missing 6ns, and there is no overshoot
  - Above 6GHz,
    no pulse width loss, no overshoot

Pulse Modulation	
Modulation source	Internal, External
Pulse modes	Single pulse, Double pulse
On/off ration	> 80 dBc (typ.)
Rise/fall time (10% / 90%)	< 15 ns (typ.)
Pulse repetition time	40 ns - 300 s



Double Pulse Modulation

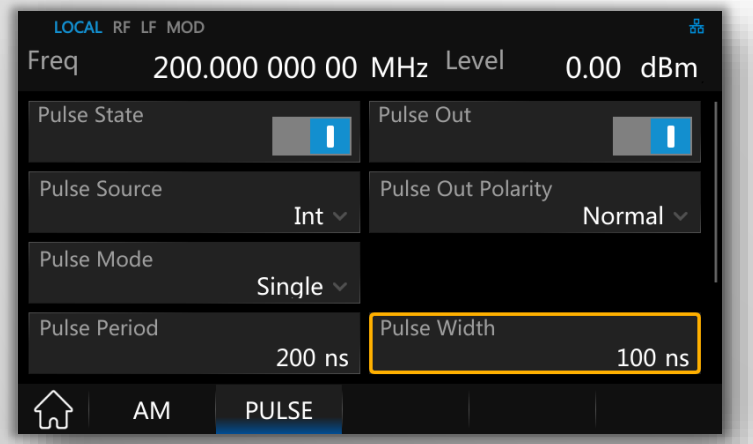


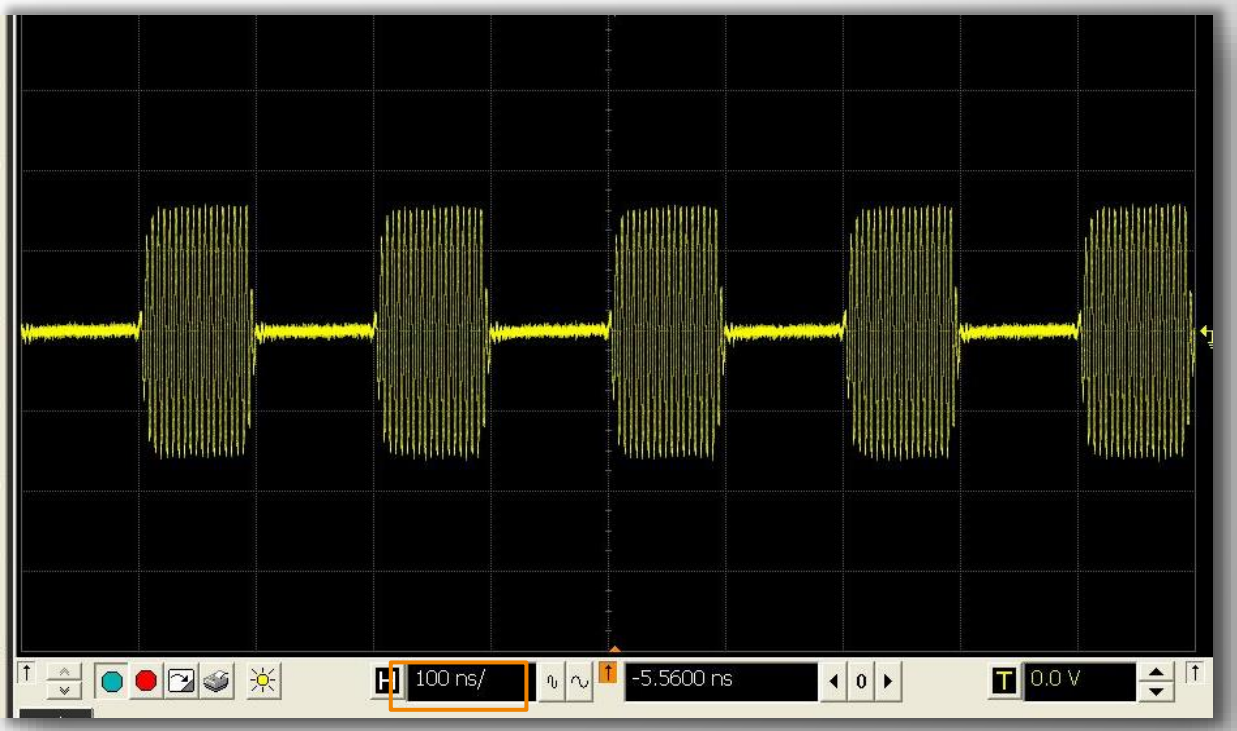
Less Pulse Width Loss

Pulse Generator (SSG6080A-PU)

- Output 100 ns pulse, the pulse widths obtained are the same

- Controlled by external pulse signal, or use single/ double pulse/ pulse train as modulation signal

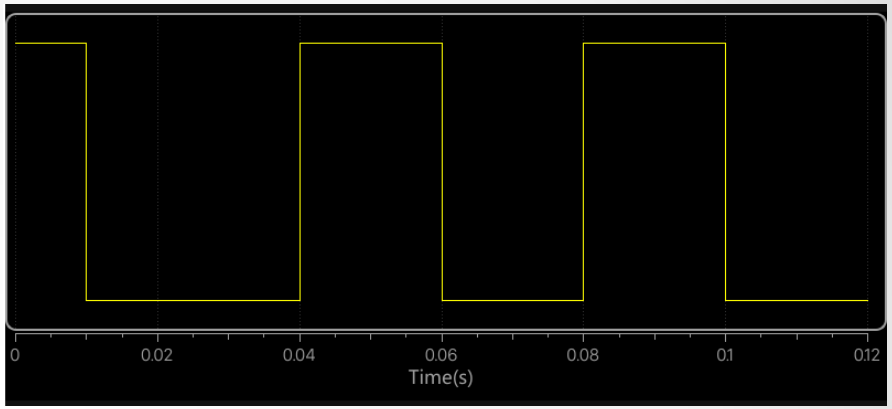




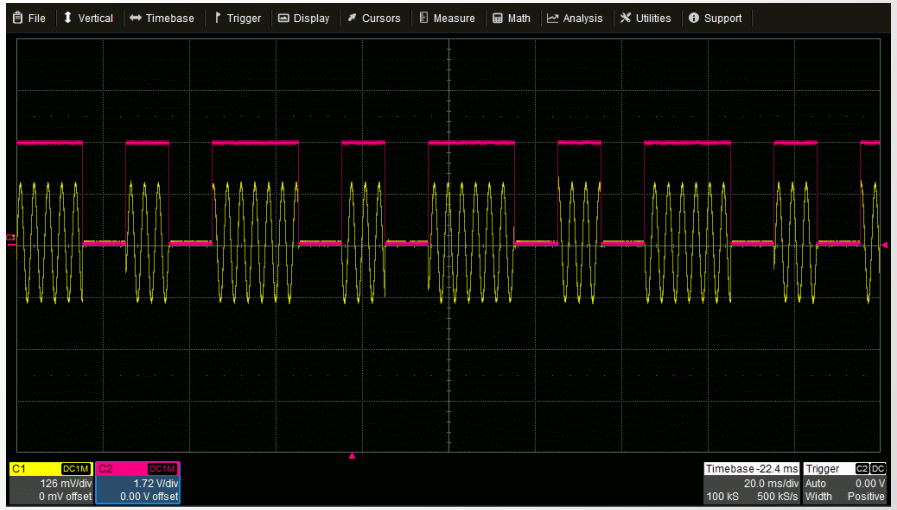
Pulse Train Generator (SSG6080A-PT)

- This produces a very long custom pulse train
- It can generate staggered pulse groups or jitter pulse widths and pulse pauses
- The pulse width and the pulse pause can be set independently and separately for each pulse

Pulse Train	
Number of pulses	1 - 2047
Number of repetitions per pulse	1 - 65535
Pulse on time and off time setting range	20 ns - 300 s
Pulse on time and off time setting resolution	10 ns



Schematic Diagram



Pulse Train

PART THREE

03

Market and Application

Capabilities and Functional Highlights

Power Control

Obtain highly accurate and stable input power

Power Compensation

- Cable Loss
- Attenuation of passive network
- Signal amplification by power amplifier
- The frequency response of each device in the link
- …

The power sensor detects the power received by the DUT

The signal source adjusts and compensates the output signal

Closed-loop power control

Power Control

Obtain highly accurate and stable input power

- Short frequency and level stabilization time
- Excellent level accuracy and repeatability to ensure high yield
- No matter what kind of power offset occurs, closed-loop power control can ensure that the tested equipment can obtain highly accurate and stable input power

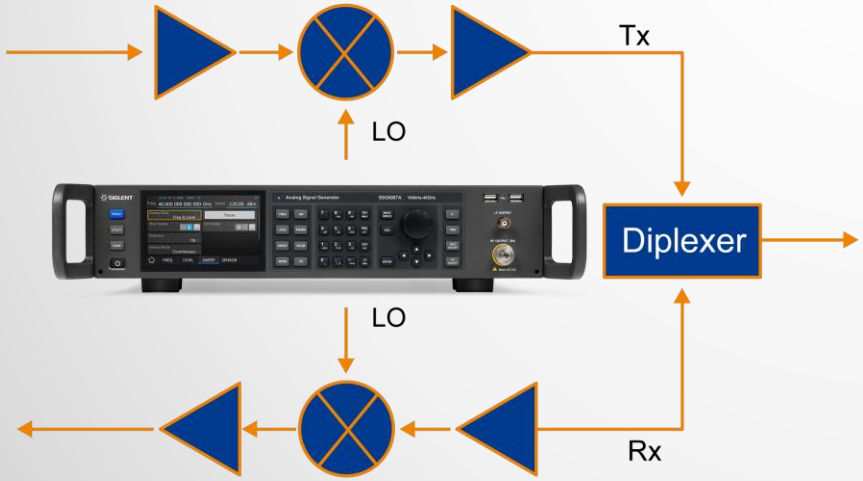
Closed-loop power control

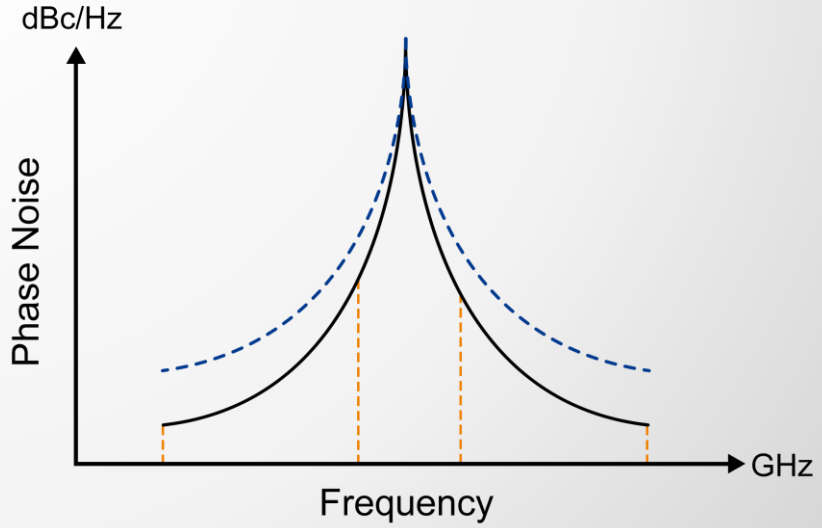
LO in Up/Down Converter Measurement

Clean CW Source for Testing Transceivers

- **Pure LO is important for testing IF up/down converters**

- **Especially when using high-order complex modulation formats**
  - Signal purity of the generator
  - Low harmonics and spurs
  - Low integrated phase noise over the signal bandwidth of interest
  - …



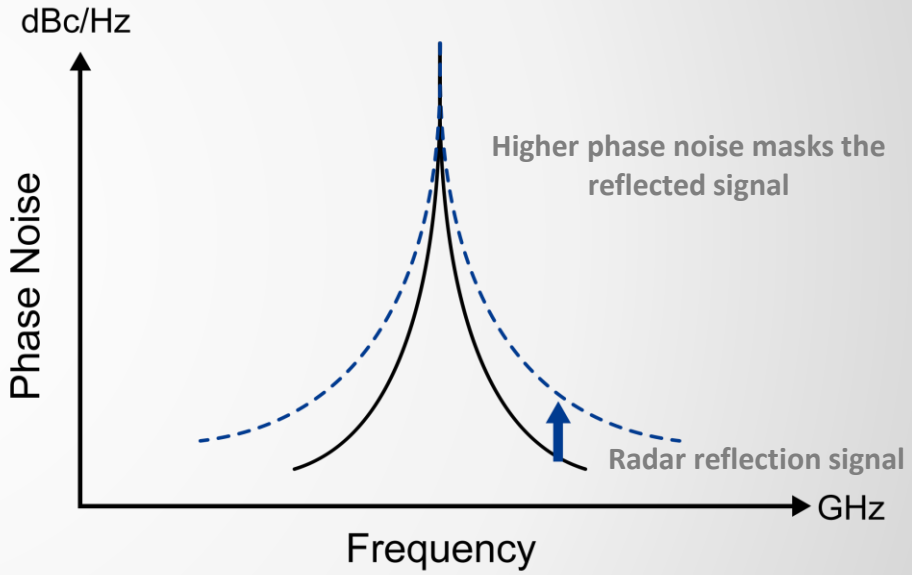


Radar System Measurement

Extremely low phase noise

Used as pulse modulation signal source or LO

- The phase noise of signal generator determines the minimum reflected signal that radar can detect
- Extremely low phase noise means that the system performance will not be masked by phase noise of signal generator
- …

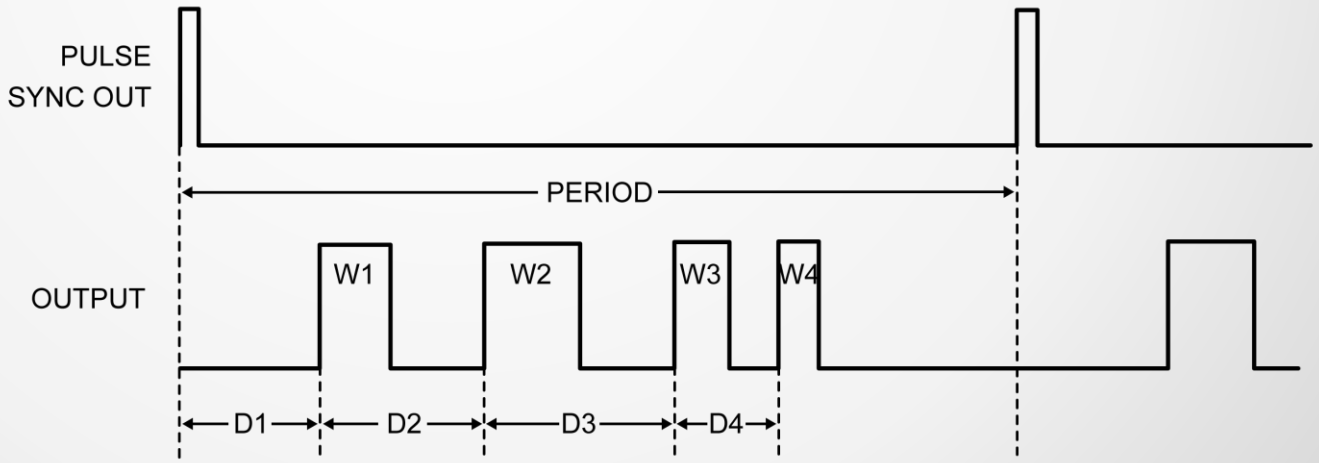


Radar System Measurement

Simulate various radar echo signals

Pulse generator simulates various radar echo signals

- One to four target signals returned from different distances
- Signals returned from moving targets approaching or leaving
- …



Nonlinear Measurement

Adequately high output power, low harmonics, sub harmonics, and non-harmonics

- **Typical nonlinear measurements of RF active devices, modules and transceivers**
  - Manufacturers of devices, such as amplifiers and mixers, measure and specify P1 dB compression point and IP2/IP3 intermodulation
  - In-band and out-of-band interference (C/I, blocking) are another class of nonlinear measurements made on all types of receivers
  - …
- **For accurate nonlinear measurement, the harmonics and spurs should be as low as possible**

Harmonics	
1 MHz < f ≤ 2 GHz	< -30 dBc
2 GHz < f ≤ 4 GHz	< -50 dBc
4 GHz < f ≤ 20 GHz	< -46 dBc

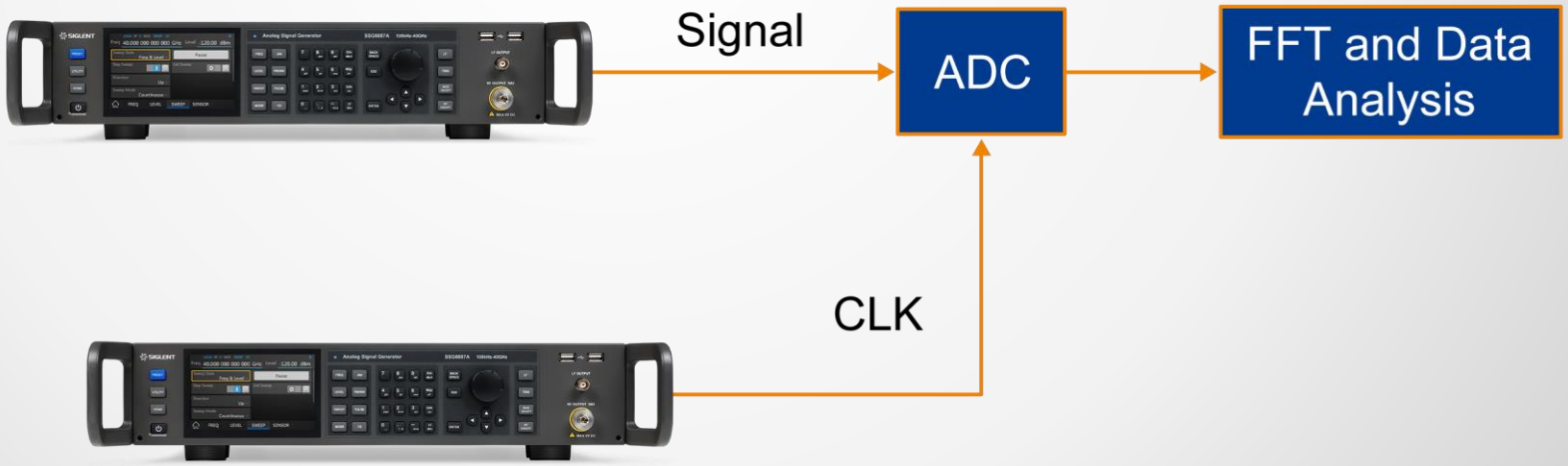
Sub harmonics	
1 MHz < f ≤ 40 GHz	< -80 dBc

Non-harmonics	
1 MHz < f ≤ 4 GHz	< -60 dBc
4 GHz < f ≤ 40 GHz	< -50 dBc

ADC Measurement

Low phase noise, harmonics, sub harmonics, and non-harmonics

- Typical ADC measurements include SNR, SFDR and ENOB
- As signal source/clock source
- **The key performance parameters of ADC measurement:**
  - Harmonics and spurs in clock and signal paths
  - Integrated phase noise /RMS jitter in clock and signal paths
  - …



ADC Measurement Setup

DAC Measurement

Low phase noise, harmonics, sub harmonics, and non-harmonics

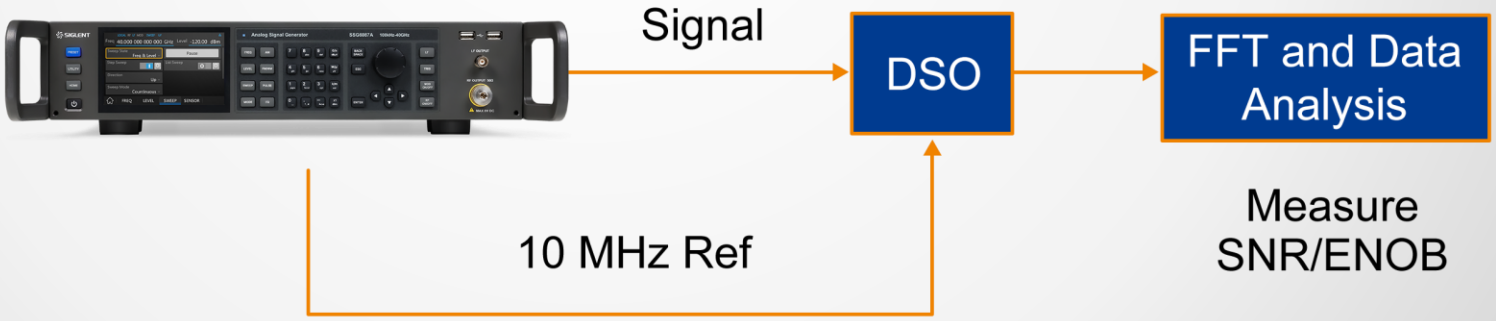
- Typical DAC measurements include SNR, SFDR and ENOB
- As signal source
- **The key performance parameters of DAC measurement:**
  - Harmonics and spurs in clock and signal paths
  - Integrated phase noise /RMS jitter in clock and signal paths
  - …

DAC Measurement Setup

DSO Measurement

Low phase noise, harmonics, sub harmonics, and non-harmonics

- Typical DSO measurements include SNR and ENOB at various input frequencies up to 10 GHz and different vertical scale settings
- As signal source
- **The key performance parameters of DSO measurement:**
  - Harmonic and subharmonic in the whole input frequency range of DSO
  - Integrate phase noise and spurs in the whole input frequency range of DSO
  - …

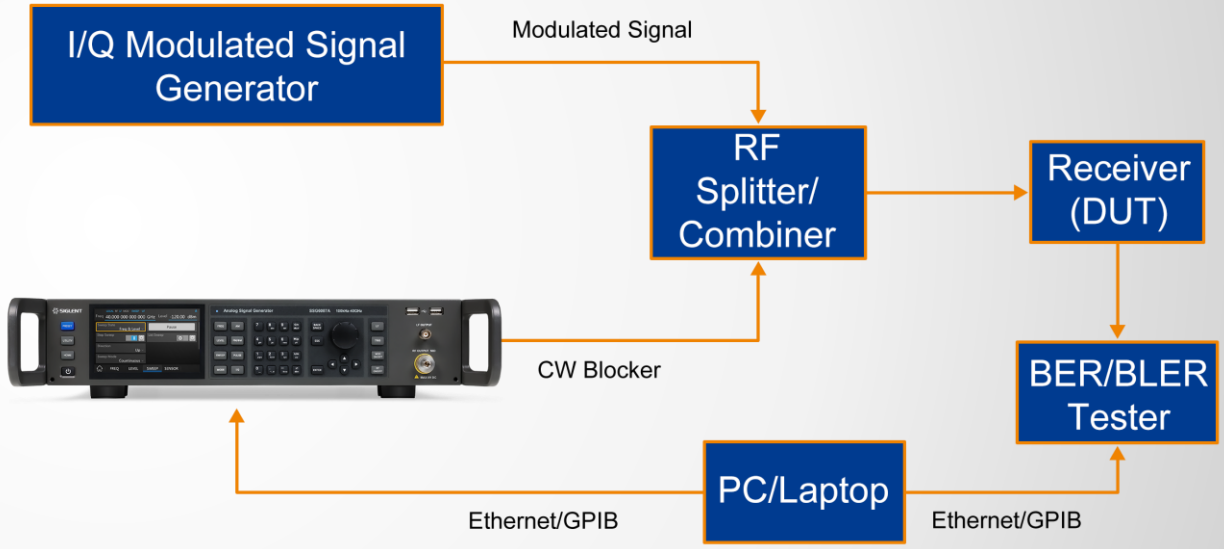


DSO Measurement Setup

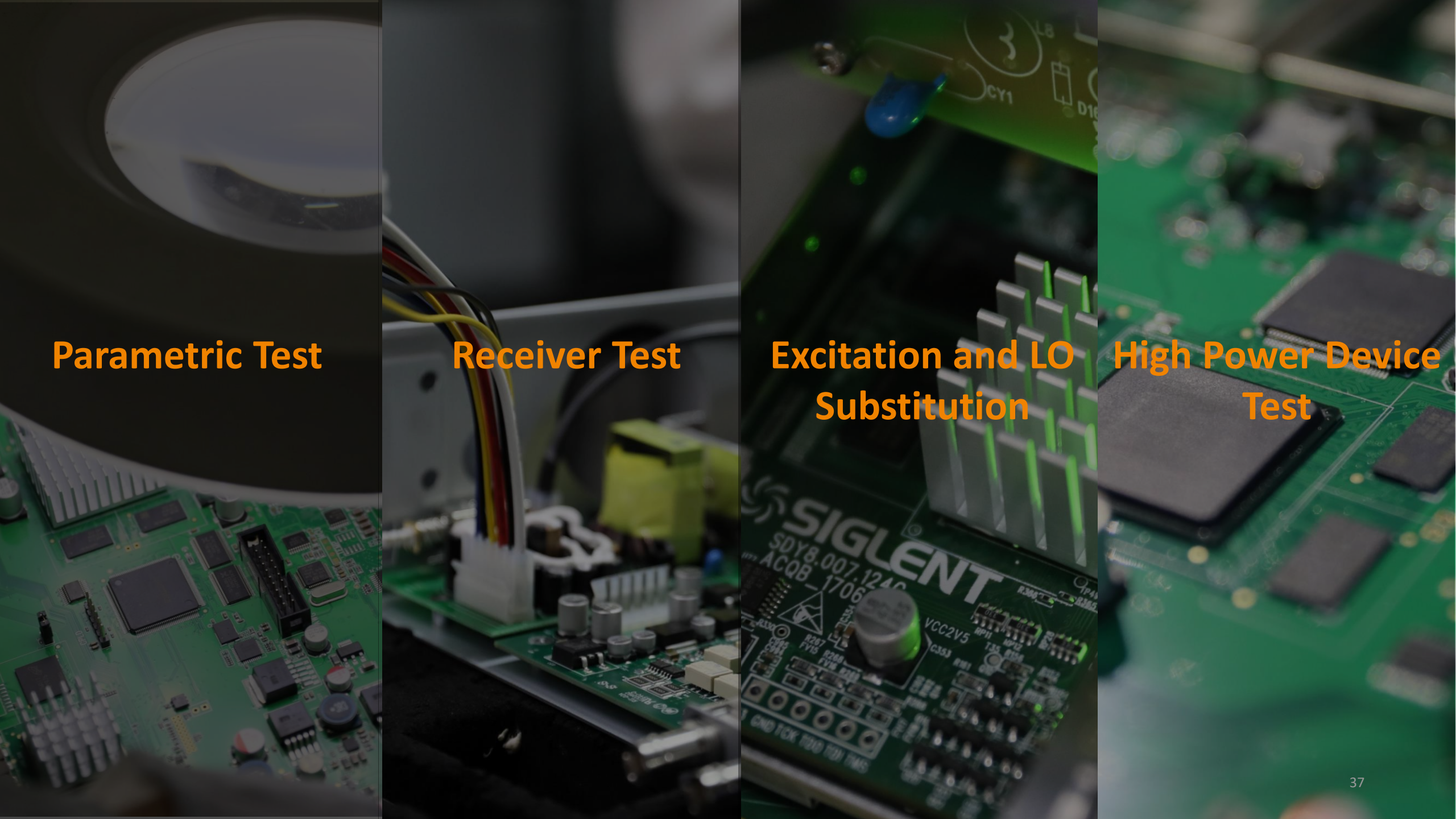
Receiver Blocking Test

Adequately high output power, low harmonics, sub harmonics, and non-harmonics

- When a small, wanted signal is received along with a large interfering signal at input of the receiver, the interfering signal desensitizes the front-end subsystem
- Blocking tests are intended to measure receiver's ability to receive, demodulate and decode successfully wanted signals in presence of large interfering signals
- **Several communication standards specify blocking test for receivers in their conformance test specifi cations**
  - 5G NR Base Station Conformance test specifi cation TS 38.141-1
  - EN 300 328 for equipment operating in 2.4 GHz ISM band which applies to Bluetooth and Wi-Fi
  - …



A Generic Receiver Blocking Test Setup


Parametric Test
Receiver Test
Excitation and LO Substitution
High Power Device Test
SIGLENT
VCC2V5

Parametric Test

- In order to fully characterize RF components, you need to understand and simulate the performance of input signals and output signals

- Use for testing and performance evaluation of various electronic devices and systems, simplifying test challenges including sensitivity, dynamic range and intermodulation distortion

High Power Device Test

- No need for external amplifier to overcome the loss of test system with higher accuracy and better stability

Receiver Test

- Characterize the receiver in various test scenarios:
  - Radiation test or conduction test
  - Minimum or maximum input level
  - Interference, blocking, intermodulation and fading
  - …
- Test of frequency range, sensitivity, dynamic range, intermodulation distortion and other indicators

Excitation and LO Substitution

- High output power & CW signal purity
- Can be used for signal excitation of precision amplifiers
- Can be used as an ideal local oscillator to replace the local oscillator in high performance transmitters and receivers

PART FOUR

04

Comparison

Comparison of similar products

Para/Model	SIGLENT SSG6000A	KEYSIGHT N5183B	KEYSIGHT N5173B	R&S SMB100A	R&S SMA100B	Anritsu MG362x1A
Appearance						
Frequency Range	100 kHz-13.6/20/40 GHz	9 kHz-13/20/31.8/40 GHz	9 kHz-13/20/31.8/40 GHz	100 kHz-12.75/20 /31.8/40 GHz	8 kHz-3/6/12.75/20 /31.8/40/50/67 GHz	9 kHz-20/43.5/70 GHz
Level Setting Range	-130 dBm to +24 dBm	-135 dBm to 30 dBm (with Option 1E1 and 1EA) -20 dBm to 19 dBm (without 1E1 and 1EA)	-135 dBm to 30 dBm (with Option 1E1 and 1EA) -20 dBm to 19 dBm (without 1E1 and 1EA)	–145 dBm to 3 dB above max	–145 dBm to +16 dBm	----
Level Resolution	0.01 dB	0.01 dB	0.01 dB	0.01 dB	0.01 dB	0.01 dB
Maximum output power	22 dBm	+18 dBm (Standard) +23 dBm (Option 1EA)	+18 dBm (Standard) +23 dBm (Option 1EA)	18 dBm	19 dBm	21 dBm
Full amplitude accuracy	< 0.7 dB	± 0.6 dB	± 0.6 dB	< 0.5 dB	< 0.7 dB	----
Phase Noise@1GHz （20 kHz offset）	-135 dBc/Hz (typ.)	-130 dBc/Hz (spec.)	-118 dBc/Hz (spec.)	10 kHz offset -128 dBc/Hz (typ.)	-140 dBc/Hz (typ.)	-10 kHz offset -138 dBc/Hz (typ.)
Harmonic (1MHz<f<2GHz)	< -30 dBc	< –48 dBc, 9 kHz to 200 MHz < –33 dBc,200 MHz to 2 GHz	< –48 dBc, 9 kHz to 200 MHz < –33 dBc,200 MHz to 2 GHz	< -30 dBc	< -30 dBc	–35dBc, 9 kHz to ≤ 31.25 MHz –58dBc,31.2MHz to ≤ 1.3 GHz
Sub Harmonics	< -80 dBc	< –75 dBc, >1.5 to 3.2 GHz < –67 dBc, >3.2 to 10 GHz < –56 dBc, >10 to 20 GHz < –53 dBc, >20 to 40 GHz	< –75 dBc, >1.5 to 3.2 GHz < –67 dBc, >3.2 to 10 GHz < –56 dBc, >10 to 20 GHz < –53 dBc, >20 to 40 GHz	None, < 6.375 GHz < –55 dBc, 6.375 to 20 GHz < –50 dBc, 20 to 40 GHz	< –85 dBc, ≤ 5 GHz < –60 dBc, > 5 GHz	----
AM Modulation	Standard	Option UNT	Option UNT	Standard	SMAB-K720 option	Option 12

Para/Model	SIGLENT SSG6000A	KEYSIGHT N5183B	KEYSIGHT N5173B	R&S SMB100A	R&S SMA100B	Anritsu MG362x1A
Appearance						
Sweep Modes	Frequency step, Arbitrary list	Frequency step, Arbitrary list	Frequency step, Arbitrary list	----	----	Frequency step, Arbitrary list
Number Of Points	Step sweep: 2-65535 List sweep: 1-500	Step sweep: 2-65535 List sweep: 1-3201	Step sweep: 2-65535 List sweep: 1-3201	----	----	2 to 65535
Step Attenuator	0 to 110 dB, 10dB step	(Option 1E1) 0 to 115 dB, 10 dB step	(Option 1E1) 0 to 115 dB, 10 dB step	Option	Option	Option 2, 10 dB step 110 dB on models 43.5 GHz
Pulse Modulation	SSG6080A-PU	Option UNW or UW2	Option UNW or UW2	SMB-K21	SMAB-K22	Option 26
Pulse On/Off Ration	>80 dB	>80 dB	>80 dB	>80 dB	>80 dB	>80 dB
Pulse Generator	SSG6080A-PU	Option UNW or UW2	Option UNW or UW2	SMB-K23	SMAB-K23	Option 27
Pulse Train Generator	SSG6080A-PT	Option UNW or UW2	Option UNW or UW2	SMB-K27	SMAB-K27	----
Number Of Pulses	1-2047	1-2047	1-2047	1-2047	1-2047	----
Pulse On Time And Off Time Setting Range	20 ns to 300 s	20ns to 42s	20ns to 42s	10 ns to 5 ms	5 ns	----
OCXO	Standard	Standard	Standard	Option	Option	Standard/ Option3/ Option56
RF Output	2.92mm male	Option 513/520: 3.5 male, or Type-N with Option 1ED; Option 532/540: 2.4 mm male; plus 2.4-2.4 mm and 2.4-2.9 mm female adapters		B112/B120: 3.5 mm female B131/B140: 2.92 mm female	B103/-B106: N female B112/-B120/B131/B140: 2.92 mm female	20.0 GHz: 2.92 mm K(m) 43.5 GHz: 2.92 mm K(m) 70 GHz: 1.85 mm V(m)

SSG5000A versus SSG6000A

Frequency offset = 20 GHz phase noise

Keys For Accuracy

01 Impedance Matching

- The output impedance of SSG6000A is 50Ω, and impedance mismatch will lead to signal amplitude reduction and high voltage standing wave ratio
- When SSG6000A is used in 75Ω, an impedance matching attenuator should be added for matching

02 Periodic Calibration

- The output frequency accuracy of SSG6000A will change with time, so it is recommended to recalibrate it annually

Keys For Accuracy

03

Time Base Preheating

- SSG6000A uses the high-stability crystal oscillator as the time reference, and the instrument must be preheated for a period of time, so that the high-stability crystal oscillator can reach its predetermined technical index before use, and the output can meet the specified stability and accuracy index

04

High-power Reverse Irrigation

- It is easy to burn the internal microwave circuit when the large signal is input back, and it is also easy to burn the internal microwave circuit when the DC voltage is input, so special attention should be paid when the output is connected to the external power amplifier

Ordering Information

Product Description	SSG6000A Signal Generator	Order Number
Product Code	Analog Signal Generator 100 kHz~13.6 GHz	SSG6083A
	Analog Signal Generator 100 kHz~20 GHz	SSG6085A
	Analog Signal Generator 100 kHz~40 GHz	SSG6087A
Standard Configurations	Quick start, USB cable, Calibration certificate, Power cord, 2.92mm female to female adapter	
Option	Pulse modulation	SSG6080A-PU
	Pulse train generator	SSG6080A-PT
	Rack mount kit	SSG6000A-RMK
	USB-GPIB adapter	USB-GPIB
	Upgrade 13.6 GHz to 20 GHz	SSG6080A-F85

Thank You

Every Bench. Every Engineer. Every Day.

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