1465A/B/C/D/F/H/L-V Signal Generator

100kHz～3GHz/6GHz/10GHz/20GHz/40GHz/50GHz/67GHz

Product Overview

1465-V series signal generators has excellent vector modulation performance within the frequency range of 100kHz-67GHz. It has 200MHz internal modulation bandwidth and 2GHz external modulation real-time bandwidth, which can meet various modulation needs of wideband signals. The generator has excellent spectrum purity and output power specifications. The phase noise of 10GHz carrier @10kHz frequency offset can be reached to -126dBc/Hz, to meet high-level test needs which have strict requirements of testing signals. The generator also has excellent vector modulation accuracy and at the full frequency range the EVM is less than 1.4%(4Msps), which makes the generator be used in metrology purpose. The baseband signal generator can be set easily with flexible performance and many modulation formats. More than 20 kinds of common modulation formats are supported, such as PSK, QAM, FSK, ASK and so on. The arbitrary wave modulation support 5 kinds of download file format, users can edit and download the waveform according to their own requirement. Thus various signal modulation can be accomplished and complex signals can be generated. Besides，the "airspace capsule" operation interface design and 10.1 inch high-brightness touch screen can bring a brand-new operation experience to users.

With wide frequency band and modulation bandwidth, 1465-V series signal generator can not only provide user with analog and vector modulated signal with great spectrum purity and modulation types, but also can help user edit arbitrary waves flexibly. It's an ideal choice for performance test of components, modules, communications, navigation, radar, and other electronic systems.
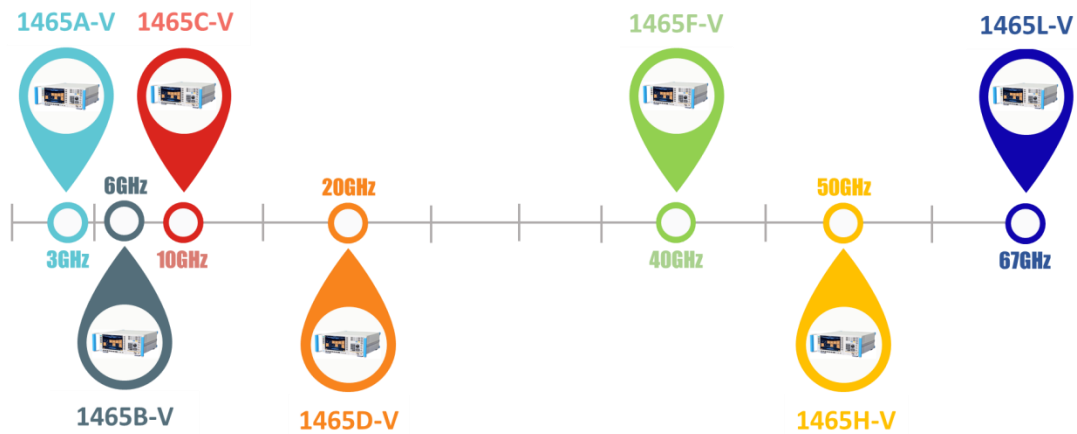
Main Characteristics

- Broadband vector signal generation

- Large vector modulation bandwidth

- High compatible arbitrary wave data format download

- High purity spectrum

- Broadband and high-power output

- Metrology grade vector modulation accuracy
- Complete universal digital modulation format
- Convenient touch screen control
- Multiple control and function extension interfaces

Broadband vector signal generation

1465-V series signal generators can provide various signal testing solutions covering 3GHz/6GHz/10GHz/20GHz/40GHz/50GHz/67GHz to meet user's specific needs in different fields. Especially, 1465L-V signal generator with 100kHz～67GHz frequency range can meet test needs of most users .
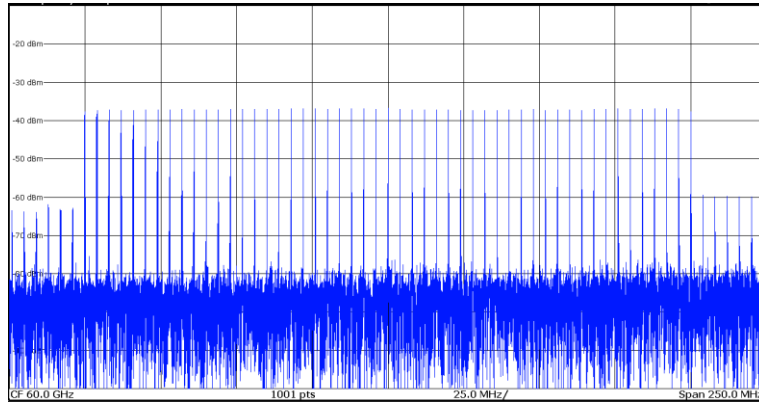

Large Vector Modulation Bandwidth

1465-V series signal generators can provide 200MHz internal modulation bandwidth and 2GHz external modulation bandwidth（above 3.2GHz carrier）vector signal generation function .
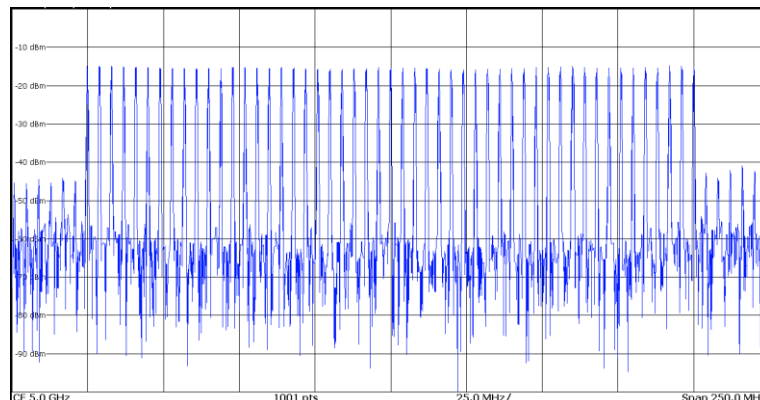

Multi-tone signal using 5GHz carrier and 200MHz modulation bandwidth

Multi-tone signal using 60GHz carrier and 200MHz modulation bandwidth

**High Compatible Arbitrary Wave Data Format Download**

1465-V series signal generators support direct download and display of arbitrary waveforms. The file formats include Mat-File 5, ASCII, Binary, cap and csv. The generator has a 2GSa storage depth.
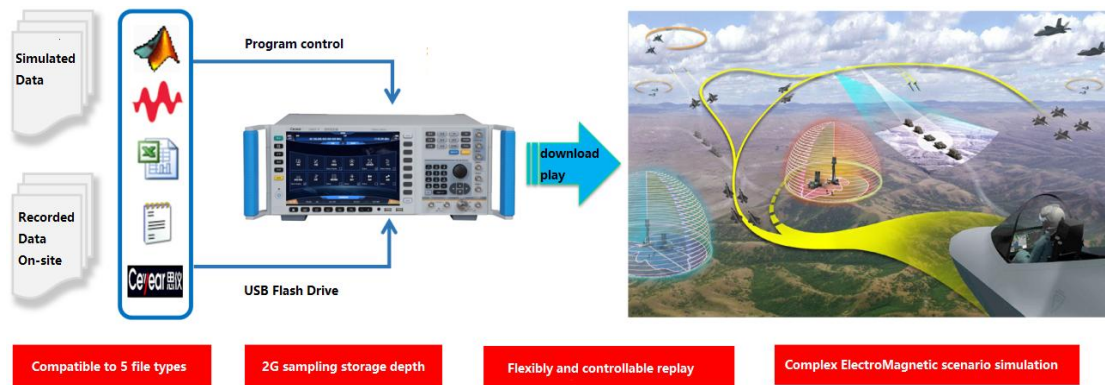
High purity spectrum

1465-V series signal generators are able to output extremely pure signal spectrum. The single side band phase noise of 10GHz carrier and 10kHz frequency offset has a typical value of -126dBc/Hz and 1GHz carrier and 10kHz frequency offset typically reaches -142dBc/Hz. It can be used for Doppler radar as well as high-performance receiver block and adjacent channel selectivity test. It also can be an ideal alternative device for local oscillator and low jitter timer.
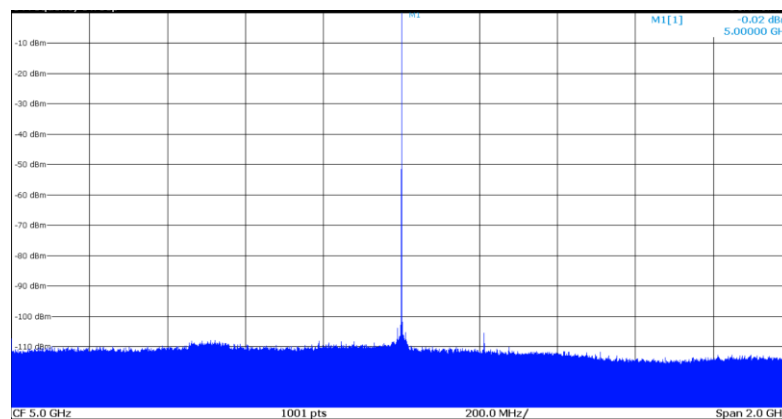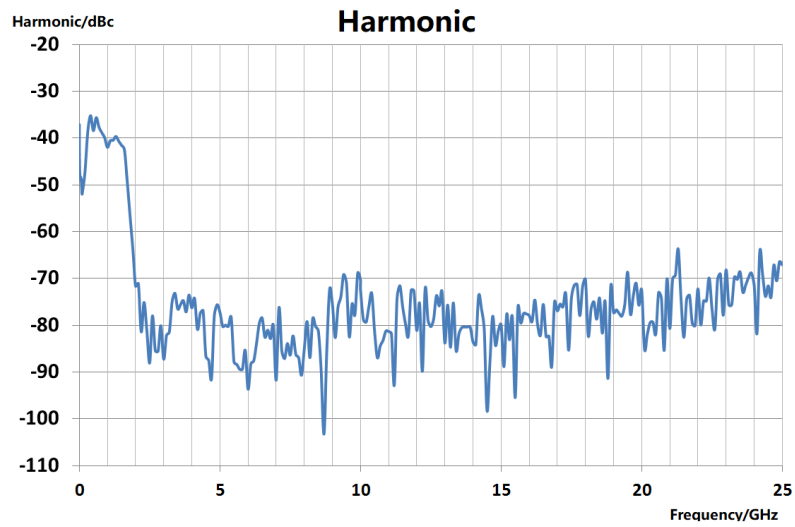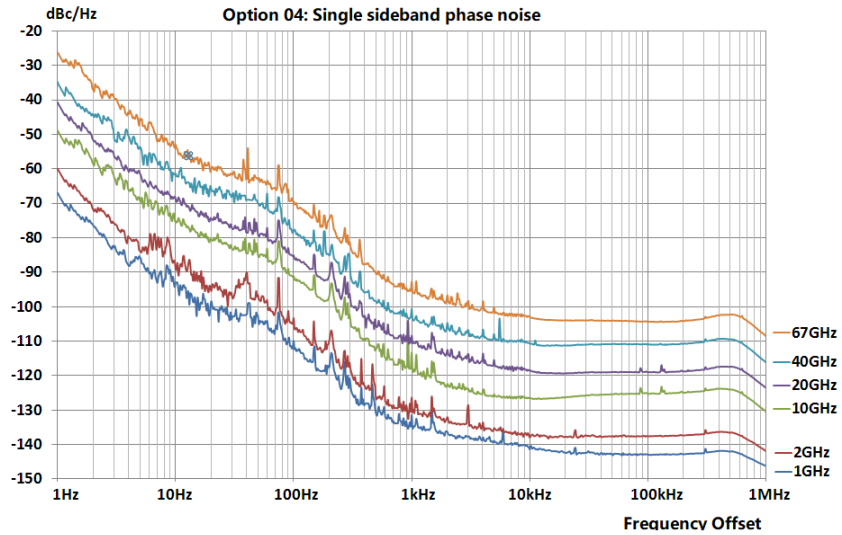
2GHz sweep width non-harmonic curve

Broadband and high-power output

For high-power option H05, typical values for the maximum output power are +22dBm at

20GHz and +16dBm at 40GHz.There's no need for an external amplifier when you need high power stimulus signal during test. And what's more, the power accuracy and stability are better.

1465D-V maximum power output (option H05)

1465F-Vmaximum power output (option H05)
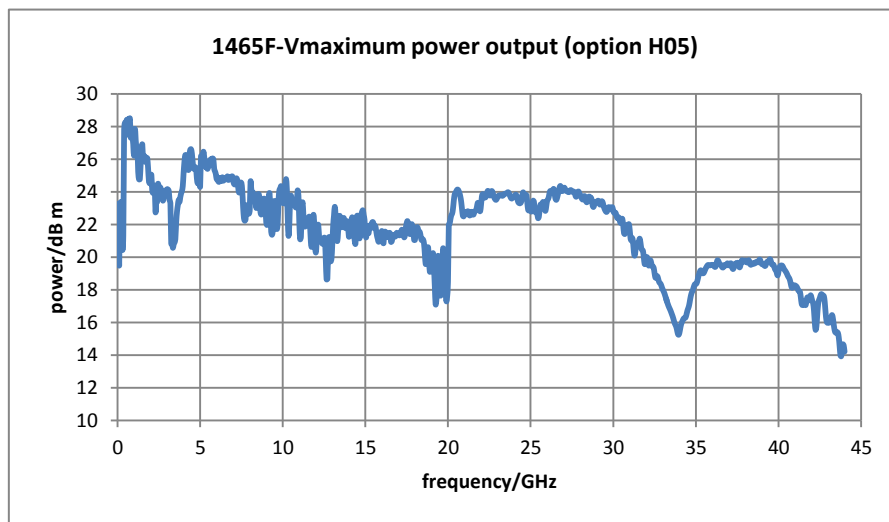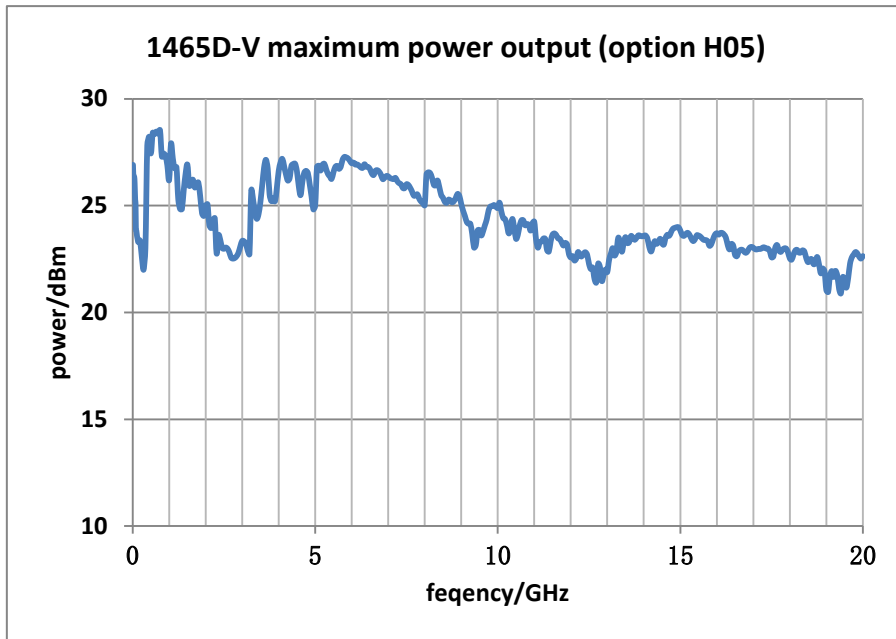
Metrology Grade Vector Modulation Accuracy

1465-V series signal generators has excellent vector modulation accuracy. The EVM is less than 1.4% (typical value<1.0%) at the frequency range 100kHz-40GHz, and EVM<2.5% (typical value<1.5%) at the frequency range 40GHz-67GHz .
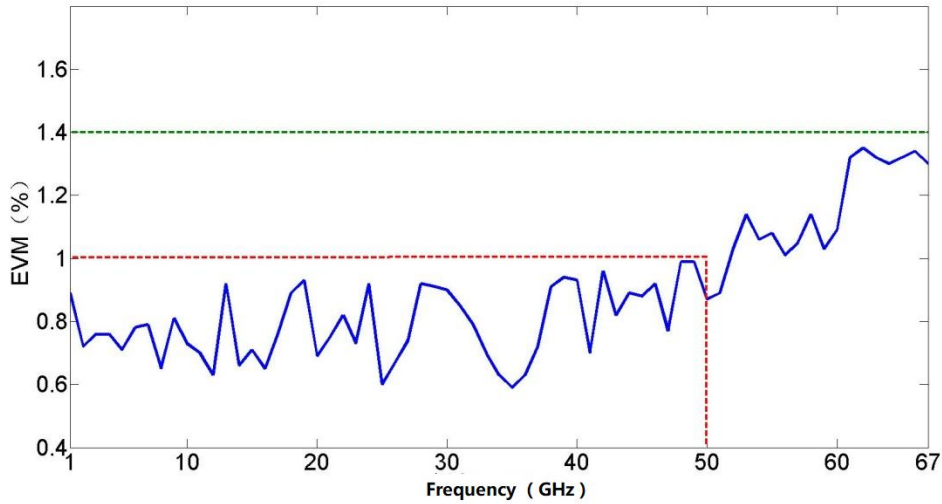
Symbol rate：4Msps, root-Nyquist filter, α=0.3, EVM test under QPSK

Complete Universal Digital Modulation Format

1465-V series signal generators can provide real-time generation of universal digital modulation signals, including more than 20 kinds of modulations, such as PSK、QAM、FSK、MSK etc.
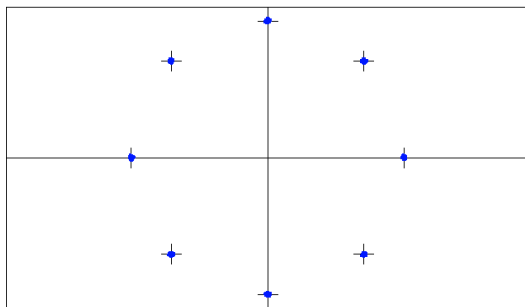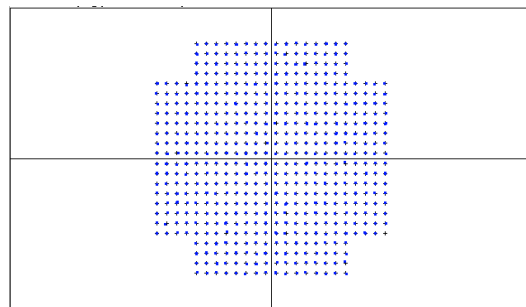
8PSK	512QAM

Convenient touch screen control

A 10.1-inch LED display screen of 1280×800 resolution shows the instrument states information clearly. Conspicuous color matching, proper function division and various function panel buttons provide a fresh sight of vision, easy operation and higher test efficiency for you. Besides with the panel buttons, the instrument can be controlled independently by operating with enter knob, sliding or clicking on the touch screen, and using external keyboard or mouse.

Multiple Control and Function Extension Interfaces

Support various auxiliary interfaces such as USB, LAN, GPIB, Monitor. The USB interface can be used for data transmission and external keyboard/mouse. LAN and GPIB can be used for programmable control. The monitor connector can be used for external display when using a CRT or LCD.

Typical Applications

High-reliability Communication system Test

1465-V series signal generator can generate high-performance user-defined modulation and basic digital modulation signal within frequency range of 100kHz～67GHz. The instrument can provide repeatable and reliable test signals for satellite communication. Its external wide bandwidth vector modulation and user-defined data features as well as additive noise function can create a real-world signal and help users to make product performance confirmation.

To Simulate Various Application Scenes for Radar and EM Environment

1465-V series signal generator has wide frequency range and high resolution(16bit)as well as powerful signal simulation function. It can generate complex sequences of various modulation formats by editing waveform segment under different scenes. Together with abundant functional synchronous trigger interface, it can simulate complex interference signal under actual environment and accomplish anti-interference test of radar equipment.

Provide Accurate Arbitrary Wave Modulation Signal

1465-V series signal generator has 2G sampling point waveform storage capacity. This feature can allow designer to generate a long-time test data, which may be more close to the reality. User can create one of the kinds of arbitrary wave data using the third party tools or software.

High-performance Receiver Test

1465-V series signal generator has a 140dB output dynamic range and extremely high frequency stability as well as 0.001Hz frequency resolution. It can output high-accuracy standard test signal which can solve parameter test problem such as sensitivity, dynamic range and channel selectivity to accomplish test of high-performance receiver used in radar, electronic warfare and communication equipment.

Local Oscillator Substitution

1465-V series signal generator has extremely high signal quality, thus can be used as an ideal device to substitute LO when testing transmitter and receiver and other systems. It will guarantee your test accuracy and creditability by avoiding negative influences that low-quality LO brings in.

Technical Specifications

Frequency properties			
Frequency range	1465A-V:100kHz~3GHz (Min. frequency of 9kHz) 1465B-V:100kHz~6GHz (Min. frequency of 9kHz) 1465C-V:100kHz~10GHz 1465D-V:100kHz~20GHz 1465F-V:100kHz~40GHz (Max. frequency of 44GHz) 1465H-V:100kHz~50GHz 1465L-V:100kHz~67GHz	Frequency	N （ Internal YO harmonic order）
		100kHz≤f≤250MHz	1/8
		250MHz＜f≤500MHz	1/16
		500MHz＜f≤1GHz	1/8
		1GHz＜f≤2GHz	1/4
		2GHz＜f≤3.2GHz	1/2
		3.2GHz＜f≤10GHz	1
		10GHz＜f≤20GHz	2
		20GHz＜f≤28.5GHz	3
		28.5GHz＜f≤50GHz	5
		50GHz＜f≤67GHz	10
Frequency resolution	0.001Hz		
Frequency switching time	＜20ms		
Time-base aging rate （Typical value[2]）	$5×10^{-10}$ /day （after 30-day continuous power-on）		
Reference output	Frequency	10MHz	
	Power	>+4dBm，to 50Ω	
Reference input	Frequency	1-50MHz，1Hz step	
	Power	-5dBm-+10dBm，50Ω impedance	
Sweep properties			
Sweep mode	Step sweep, List sweep, Analog sweep, Power sweep		
Analog sweep (option H03)	Max. sweep speed	100kHz≤f≤500MHz	25MHz/ms
		500MHz＜f≤1GHz	50MHz/ms
		1GHz＜f≤2GHz	100MHz/ms
		2GHz＜f≤3.2GHz	200MHz/ms
		3.2GHz＜f	400MHz/ms
	Sweep accuracy	0.05 % Sweep width （for 100m, within the maximum width of 100ms as specified）	

Power properties					
Min. power	Model	Standard package	Option H01A/B		
	1465A/B/C/D/F-V	-20dBm	-110dBm （-135dBm configurable）		
	1465H/L-V	-20dBm	-90dBm （-110dBm configurable）		
Max. power （25±10℃）	Frequency range	Standard package	H01A/B programmable	H05 high	Options H01A/B+

		step attenuator option	power output option	H05
	1465A/B/C/D-V			
	100kHz≤f≤20GHz	15dBm	15dBm	20^3dBm	20^3dBm
	1465F-V			
	100kHz≤f≤9GHz	10dBm	10dBm	18dBm	18dBm
	9GHz＜f≤30GHz	10dBm	10dBm	15dBm	15dBm
	30GHz＜f≤40GHz	10dBm	10dBm	12dBm	12dBm
	1465H/L-V			
	100kHz≤f≤15GHz	5dBm	5dBm	15dBm	15dBm
	15GHz＜f≤30GHz	5dBm	5dBm	12dBm	12dBm
	30GHz＜f≤60GHz	5dBm	4dBm	8dBm	6dBm
	60GHz＜f≤67GHz	4dBm	3dBm	6dBm	4dBm

Power accuracy (25±10℃)

Standard

Power Frequency（dBm）	>10～20	>-10～10	-20～-10
100kHz≤f≤2GHz	±0.8dB	±0.6dB	±1.5dB
2GHz＜f≤20GHz	±0.8dB	±0.8dB	±1.5dB
20GHz＜f≤40GHz	±1.0dB	±0.9dB	±1.8dB
40GHz＜f≤50GHz	---	±1.3dB	±1.8dB
50GHz＜f≤67GHz	---	±1.5dB	±2.0dB

H01A/B programmable step attenuator option

Power Frequency（dBm）	>10～20	>-10～10	>-70～-10	-90～-70
100kHz≤f≤2GHz	±0.8dB	±0.6dB	±0.7dB	±1.5dB
2GHz＜f≤20GHz	±0.8dB	±0.8dB	±0.9dB	±1.8dB
20GHz＜f≤40GHz	±1.0dB	±0.9dB	±1.0dB	±2.0dB
40GHz＜f≤50GHz	---	±1.3dB	±1.5dB	±2.5dB
50GHz＜f≤67GHz	---	±1.5dB	±1.8dB	±3.0dB

Power resolution	0.01dB
Power temperature Stability	0.02dB/℃（typical value）
Output Impedance	50Ω（Rating[4]）

VSWR (Internal fixed amplitude) (typical Value)	100kHz≤f≤20GHz	＜1.6
	20GHz＜f≤40GHz	＜1.8
	40GHz＜f≤67GHz	＜2.0

Max. reverse power	0.5W（0V DC）（rating）

Spectrum purity[5]

Harmonic (at +10dBm or Max.	Frequency	Standard package
	100kHz≤f≤10MHz	＜-25dBc

specified output power, whichever is lower)	10MHz＜f≤2GHz	＜-30dBc					
	2GHz＜f≤6GHz (1465B)	＜-30dBc					
	2GHz＜f≤20GHz	＜-55dBc					
	20GHz＜f≤67GHz	＜-45dBc（typical value）					
Sub-harmonic (at +10dBm or Max. specified output power, whichever is lower)	100kHz≤f≤10GHz	None					
	10GHz＜f≤20GHz	＜-60dBc					
	20GHz＜f≤67GHz	＜-45dBc					

Non-harmonic (at 0dBm, beyond 3kHz offset)	Frequency	Standard package	Option H04
	100kHz≤f≤250MHz	＜-58dBc	＜-58dBc
	250MHz＜f≤3.2GHz	＜-74dBc	＜-80dBc
	3.2GHz＜f≤10GHz	＜-62dBc	＜-70dBc
	10GHz＜f≤20GHz	＜-56dBc	＜-64dBc
	20GHz＜f≤28.5GHz	＜-52dBc	＜-52dBc
	28.5GHz＜f≤40GHz	＜-45dBc	＜-45dBc
	40GHz＜f≤60GHz	＜-42dBc	＜-42dBc

Single side band phase noise (dBc/Hz, +10dBm or Max. output power, whichever is smaller)	Frequency	1Hz	10Hz	100Hz	1kHz	10kHz	100kHz
	100kHz≤f≤250MHz	---	---	-104	-121	-128	-130
	250MHz＜f≤500MHz	---	---	-108	-126	-132	-136
	0.5 GHz＜f≤1GHz	---	---	-101	-121	-130	-130
	1GHz＜f≤2GHz	---	---	-96	-115	-124	-124
	2GHz＜f≤3.2GHz	---	---	-92	-111	-120	-120
	3.2GHz＜f≤10GHz	---	---	-81	-101	-110	-110
	10GHz＜f≤20GHz	---	---	-75	-95	-104	-104
	20GHz＜f≤28.5GHz	---	---	-69	-89	-98	-98
	28.5GHz＜f≤50GHz	---	---	-64	-84	-92	-92
	50GHz＜f≤67GHz	---	---	-57	-77	-86	-86
	H04 ultra low phase noise option						
	100kHz≤f≤250MHz[6]	-64	-92	-105	-123	-138	-141
	250MHz＜f≤500MHz	-67	-93	-111	-126	-138	-142
	0.5GHz＜f≤1GHz	-62	-91	-105	-123	-138	-138
	1GHz＜f≤2GHz	-57	-86	-100	-117	-133	-133
	2GHz＜f≤3.2GHz	-52	-81	-96	-113	-128	-128
	3.2GHz＜f≤10GHz	-43	-72	-85	-105	-120	-120
	10GHz＜f≤20GHz	-37	-66	-79	-98	-114	-114
	20GHz＜f≤28.5GHz	-31	-60	-73	-91	-108	-108
	28.5GHz＜f≤50GHz	-26	-54	-68	-85	-102	-102
	50GHz＜f≤67GHz	-20	-48	-62	-79	-96	-96

Modulation properties

Frequency Modulation (option H02A)	Maximum deviation：N×16MHz (N: YO harmonic number) Accuracy (at 1kHz, N×20kHz≤deviation<N×800kHz): <±(3.5%×set frequency offset + 20Hz) Modulation rate(3dB bandwidth, N×500kHz frequency offset): DC-10MHz Distortion(at 1kHz, N×20kHz≤deviations<N×800kHz): <1%		
Phase Modulation (option H02A)	Maximum deviation： Normal mode: N×16rad (N: YO harmonic number) Broadband mode: N×1.6rad (N is YO harmonic number) Accuracy(at 1kHz, N×0.2rad≤deviations＜N×8rad, normal mode) <±(5% of deviation + 0.01 rad) Modulation rate (3dB bandwidth，Broadband mode): DC～10MHz (typical value) Distortion (at 1kHz, N×0.8rad≤deviations＜N×8rad, THD): <1%		
Amplitude modulation (option H02A)	Max. depth：＞90％ Modulation rate (3 dB bandwidth, 30% modulation depth): DC～100kHz Accuracy (1kHz modulation rate, 30% modulation depth): ±(6% of setting + 1%) Distortion (1kHz modulation rate, linear mode, THD, 30% modulation depth): <1.5%		
Pulse Modulation (option H02B)		500MHz-3.2GHz	>3.2GHz
	Switch ratio	>80dB	>80dB
	Rise and fall time	<20ns	<20ns
	Min. pulse width with ALC on	1μs	1μs
	Min. pulse width with ALC off	0.1μs	0.1μs
Narrow pulse Modulation (option H02C)		50MHz-3.2GHz	>3.2GHz
	Switch ratio	>80dB	>80dB
	Rise and fall time	<15ns	<10ns
	Min. pulse width with ALC on	1μs	1μs
	Min. pulse width with ALC off	30ns	20ns

Internal modulation signal generator (option H02A/B/C)	There are 3 independent signals respectively for frequency/phase modulation, amplitude modulation and low frequency output signals.
	 Waveform: sine, square, triangle, Sawtooth, noise, double sine, sweep sine.
	 Frequency range: DC～10MHz for sine, double sine, sweep sine; 0.1Hz～100kHz for square, triangle, sawtooth.
	 Frequency resolution: 0.1Hz
	 Low frequency output: Amplitude: 0-5Vpeak(rating), to 50Ω load.
	 Pulse modulation signal: pulse width: 20ns-(42s-10ns);
	                            pulse period: 100ns-42s;
	                            resolution: 10ns.		

Vector modulation accuracy(after	1465A/B/C/D/F-V	50MHz-40GHz(or max. frequency)	EVM(RMS%)<1.4%

calibration, 25 ℃ ±10℃) (4Msps, root-Nyquist, α=0.3, QPSK, 0dBm)	1465H/L-V	50MHz-40GHz	EVM(RMS%)<1.4%
		40GHz-67GHz(or max. frequency)	EVM(RMS%)<2.5%
Internal modulation bandwidth	(Carrier 900MHz, 1.8GHz, 2.4GHz, 6GHz, 18GHz, 35GHz, 50GHz) Standard package： 120MHz(Multi-tone, Tone quantity: 51, Frequency space: 2.4MHz,±3dB bandwidth); H3 large modulation bandwidth option: 200MHz(Multi-tone, Tone quantity: 51, Frequency space: 4MHz, ±3dB bandwidth).		
External modulation Bandwidth	(Carrier 900MHz、1.8GHz、2.4GHz、6GHz、18GHz、35GHz、50GHz) 200MHz(ALC OFF, input 100mVrms sine to channel I, ±4dB bandwidth)		
External wide modulation Bandwidth (option H33)	(6GHz、18GHz、35GHz、50GHz) 2GHz(ALC OFF, input 100mVrms sine to channel I, ±4dB bandwidth)		
Internal baseband signal generator	Channel quantities：2(I and Q) Max. symbol rate: standard package: 60Msps(Max. 4bit/symbol) option H31: 125Msps(Max. 4bit/symbol) Baseband waveform internal memory: standard package: 1GSa option H32: 2GSa Modulation format： PSK: BPSK, QPSK, OQPSK, π/4 DQPSK, D8PSK, 16PSK; QAM: 4, 16, 32, 64, 128, 256, 512, 1024; FSK: 2, 4, 8, 16; ASK;MSK; Arbitrary wave modulation. Dual-tone mode max. frequency offset: 200MHz EVM: <1.0%(typical value)(RMS%, Symbol rate 4Msps, root-Nyquist, α=0.3, QPSK)		
General properties			
RF output port	1465A/B/C-V: N(female), impedance 50Ω. 1465D-V: 3.5mm(male), N(female)(option H91), impedance 50Ω. 1465F-V: 2.4mm(male), impedance 50Ω.		
Max. Physical Dimension	W×H×D: 517mm×192mm×550mm		
Weight	<28 kg(as per model and option configuration)		
Power Supply	100-120VAC, 50-60Hz; or 200-240VAC, 50～60Hz(self-adaptive)		
Power Consumption	<400W		
Temperature Range	Working temperature：0℃～+50℃；Storage temperature：-40℃～+70℃		

Notes：

1. When 1465-V series signal generator is under environment temperature for 2 hours, attenuator is automatically coupling（or ALC power＞-5dBm）after 30 minutes warm-up time. The

generator meets every parameter performance within given working temperature.

2. Typical value is a supplementary characteristic just for user's reference. These specifications are not guaranteed.

3. 1465B-V is +16dBm.

4. Rating value is an expected performance, or used to describe the product performance which is useful but not included in product performance warranty.

5. Spectral purity parameter is tested in a certain frequency without any modulation.

6. The single sideband phase noise of 100kHz≤f≤250MHz is tested a output power of +15dBm. The working frequency range of option H06 is greater than 100MHz，so there's no tested specification under 100MHz.

Ordering Information

- Main Unit

    1465A-V Signal Generator 100kHz～3GHz
    1465B-V Signal Generator 100kHz～6GHz
    1465C-V Signal Generator 100kHz～10GHz
    1465D-V Signal Generator 100kHz～20GHz
    1465F-V Signal Generator 100kHz～40GHz
    1465H-V Signal Generator 100kHz～50GHz
    1465L-V Signal Generator 100kHz～67GHz

- Standard Package

No.	Description	Remarks
1	Power cable assembly	Standard three-core power cord
2	User Manual	--
3	Programming Manual	--
4	Certificate of Conformity	--

- Options

Model	Description	Function	Match
1465-H01A	115dB programmable step attenuator	To expand output power dynamic range	Optional for A/B/C/D/F-V
1465-H01B	90dB programmable step attenuator	To expand output power dynamic range	Optional for H/L-V
1465-H02A	Analog modulation	Add analog modulation function	Optional for all models
1465-H02B	Pulse modulation	Add pulse modulation function，100ns min. pulse width	Optional for all models
1465-H02C	Narrow pulse	Add pulse modulation function,	Optional for all models,

	modulation	20ns min. pulse width	including H02B
1465-H03	Analog sweep frequency	Add analog sweep frequency function（slope sweep）	Optional for all models
1465-H04	Ultra-low phase noise	Optimize phase noise ，10GHz@10kHz：-120dBc/Hz	Optional for all models
1465-H05	Large power output	Improve max. output power	Optional for all models
1465-H31	Large modulation bandwidth	Expand internal modulation bandwidth to 200MHz	Optional for all models
1465-H32	Internal baseband large capacity memory	Expand internal baseband memory to 8GB	Optional for all models
1465-H33	Wideband external IQ input	Add wideband external IQ input function	Optional for 1465C/D/F-V
1465-H80	87230 USB power sensor	For power measurement and calibration（50MHz-6GHz）	Optional for all models
1465-H81	87231 USB power sensor	For power measurement and calibration（50MHz-18GHz）	Optional for all models
1465-H82	87232 USB power sensor	For power measurement and calibration（50MHz-26.5GHz）	Optional for all models
1465-H83	87233 USB power sensor	For power measurement and calibration（50MHz-40GHz）	Optional for all models
1465-H90	GJB EMC	Meet GJB-151A EMC regulation（without touch screen function）	Optional for all models
1465-H91	N type RF output interface	Change RF output port to N type（female），only optional for 1465D-V	Optional for 1465D-V
1465-H92	Rear panel RF output	Move RF output port to rear panel	Optional for all models
1465-H94	Rack mount kit	Mount kit for rack	Optional for all models
1465-H95	Commercial calibration certificate	Entrust metering institute to meter the instrument	Optional for all models
1465-H96	5 years extended warranty	Extend warranty to 5 years	Optional for all models
1465-H97	Color printing user manual	User manual and programming manual are color printed	Optional for all models
1465-H98	English options	Panel, software interface, user manual and programming manual are English version	Optional for all models
1465-H99	Aluminum alloy transport case	High-intensity portable aluminum alloy transport case, with carrying handle and	Optional for all models

		omni-directional wheel, convenient for transportation	