S1465 Series Signal Generator

Datasheet

Saluki Technology Inc.

The document applies to the Signal Generators of the following models:

- S1465C signal generator: 100kHz - 10GHz
- S1465D signal generator: 100kHz - 20GHz
- S1465F signal generator: 100kHz - 40GHz
- S1465H signal generator: 100kHz - 50GHz
- S1465L signal generator: 100kHz - 67GHz

Signal generator Standard pack and accessories:

No.	Item
1	Main machine
2	Power cable assembly
3	User manual
4	Certificate of quality

Options of the S1465 series Signal Generator in addition to standard accessories:

Option ID	Description	Function	Match
S1465-H01A	115dB programmable step attenuator	To expand output power dynamic range	For model S1465C/D/F
S1465-H01B	90dB programmable step attenuator	To expand output power dynamic range	For model S1465H/L
S1465-H02A	Analog modulation	Additional analog modulation, including AM, FM, ΦM, and low-frequency output	All models
S1465-H02B	Pulse modulation	Additional pulse modulation, with the minimum pulse width of 100ns	All models
S1465-H02C	Narrow pulse modulation	Additional pulse modulation, with the minimum pulse width of 20ns	All models, including H02B
S1465-H03	Analog sweep	Additional analog sweep (slope sweep)	All models
S1465-H04	Ultra low phase noise	To reduce phase noise, 10GHz@10kHz: -120dBc/Hz	All models
S1465-H05	High-power output	To increase the maximum output power	All models
S1465-H06	Enhanced high-power output	To increase the maximum output power of	Only S1465D option

		10MHz-20GHz substantially	
S1465-H80	S87230 USB power probe	For power measurement and calibration (9kHz-6GHz)	All models
S1465-H81	S87231 USB power probe	For power measurement and calibration (10MHz-18GHz)	All models
S1465-H82	S87232 USB power probe	For power measurement and calibration (50MHz-26.5GHz)	All models
S1465-H83	S87233 USB power probe	For power measurement and calibration (50MHz-40GHz)	All models
S1465-H90	Electromagnetic compatibility	As specified in GJB-151A (touch screen disabled)	All models
S1465-H91	N RF output port	To change RF output port to N (female)	Only S1465D option
S1465-H92	Rear panel RF output	To move RF output port to rear panel	All models
S1465-H93	Front handle kit	Front panel mounting handle	All models
S1465-H94	Rack installation kit	Kit for installing instrument on the cabinet	All models
S1465-H95	Commercial calibration certificate	Instrument is entrusted to metrology service	All models
S1465-H99	Aluminum alloy transport case	For safety transportation	All models
S1465-S10	Complex pulse sequence (software)	Pulse generation mode expansion, support double pulse, multi-pulse, re-frequency staggered, re-frequency jitter, re-frequency slip and other complex pulse sequence generation (need option H02B/C)	All models

Preface

Thank you for choosing S1465 series signal generators produced by Saluki Technology Inc.

We devote ourselves to meeting your demands, providing you high-quality measuring instrument and the best after-sales service. We persist with “superior quality and considerate service”, and are committed to offering satisfactory products and service for our clients.

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Saluki Technology

Document Authorization

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Product Quality Assurance

The warranty period of the product is 36 months from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period.

Product Quality Certificate

The product meets the indicator requirements of the document at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

Quality/Settings Management

Research, development, manufacturing and testing of the product comply with the requirements of the quality and environmental management system.

Contacts

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1. Overview

S1465 series signal generators, with the frequency range of 100kHz - 67GHz, are provided with high purity spectrum and high output power. The maximum output power reaches up to 1W at 20GHz carrier, and the dynamic output power range gets 150dB. All these specifications can meet the high-end requirements of electromagnetic signal tests. In addition, S1465 series signal generators own the functions of high-precision analog sweep and high-performance analog and pulse modulation, with maximum bandwidth of internally modulated signal generator up to 10MHz, various signal waveforms, the minimum pulse width of 20ns and flexible pulse trains, which can meet the test requirements of analog and pulse modulations. A 10.1-in. display screen of 1280×800 resolution as well as a number of independent operation styles, such as buttons, mouse and touch screens are equipped so as to improve user experience and test efficiency. S1465 signal generators can generate high-quality continuous-wave or modulated signals, which are not only ideal local oscillation source and clock source, but also high-performance analog simulation signal source. They are mainly used in the radar performance evaluation, high-performance receiver test and components parameter test etc., and applicable to aviation, aerospace, radar, communication and navigation equipment etc.

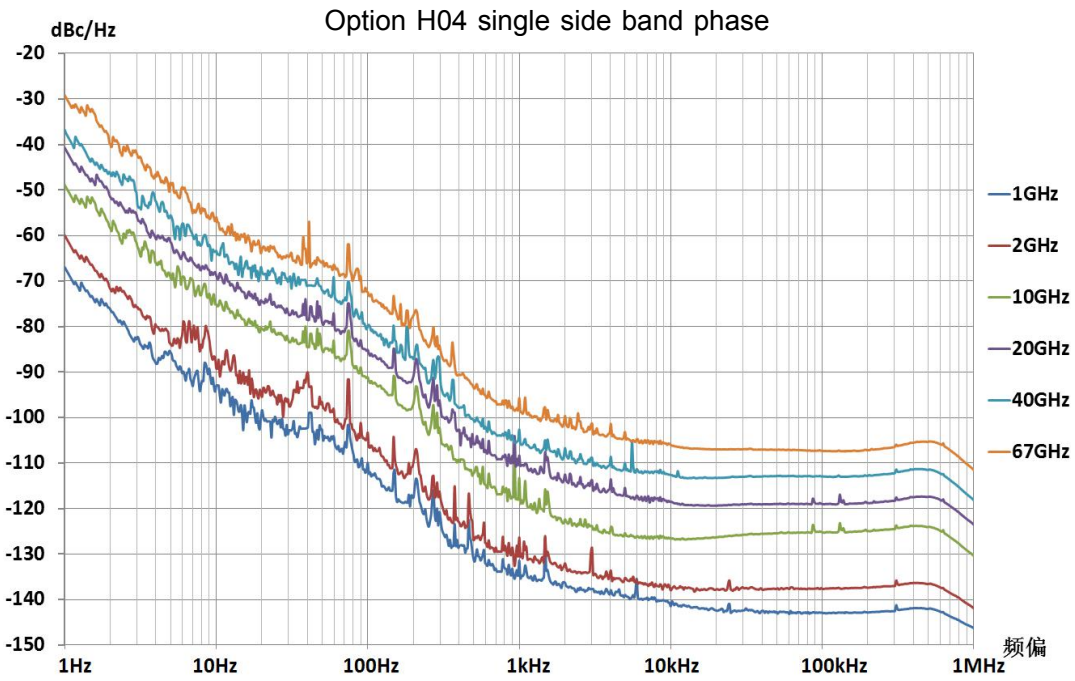
2. Main characteristics

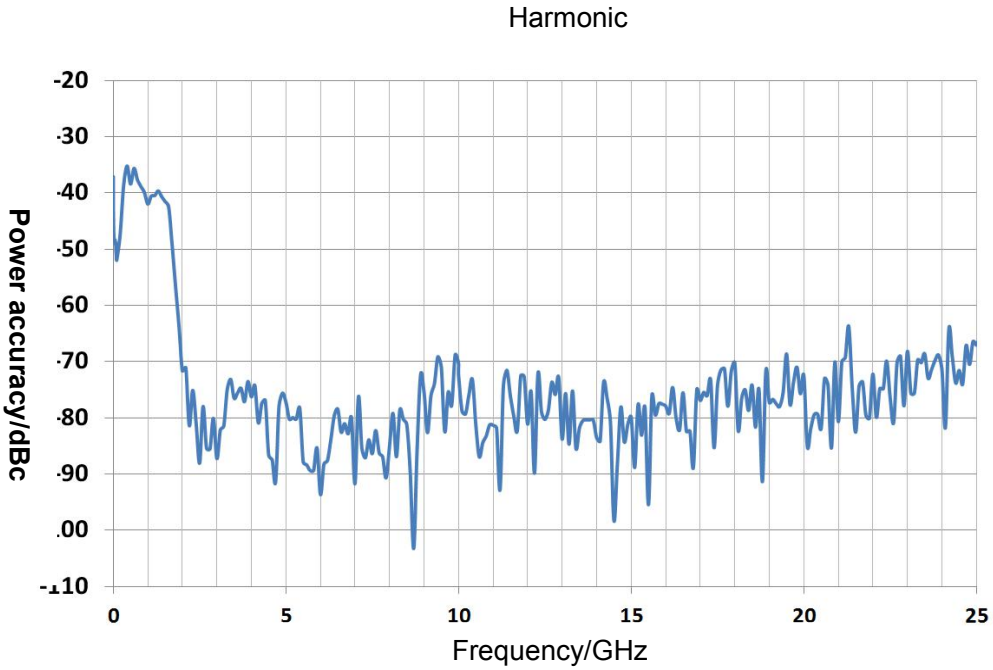
- High purity spectrum
- Broadband and high-power output
- High stability frequency and power output
- Convenient touch screen control
- Complete frequency band serialization
- High-precision analog sweep
- Super-high power dynamic range
- Excellent analog modulation
- High-performance pulse modulation
- Multiple control and function extension interfaces

3. Advantage Characteristics

3.1 High purity spectrum

S1465 series signal generators are able to output extremely pure signal spectrum, typical single side band phase noise at 10GHz carrier and 10kHz frequency offset of -126dBc/Hz, and at 1GHz carrier and 10kHz frequency offset of -142dBc/Hz. This performance can be used in Doppler radar, high-performance receiver blocking and adjacent channel selectivity tests, and are ideal alternatives to local oscillator and low-jitter clock.


Option H04 single side band phase
dBc/Hz
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
1Hz
10Hz
100Hz
1kHz
10kHz
100kHz
1MHz
频偏
1GHz
2GHz
10GHz
20GHz
40GHz
67GHz


Harmonic
Power accuracy/dBc
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
0
5
10
15
20
25
Frequency/GHz

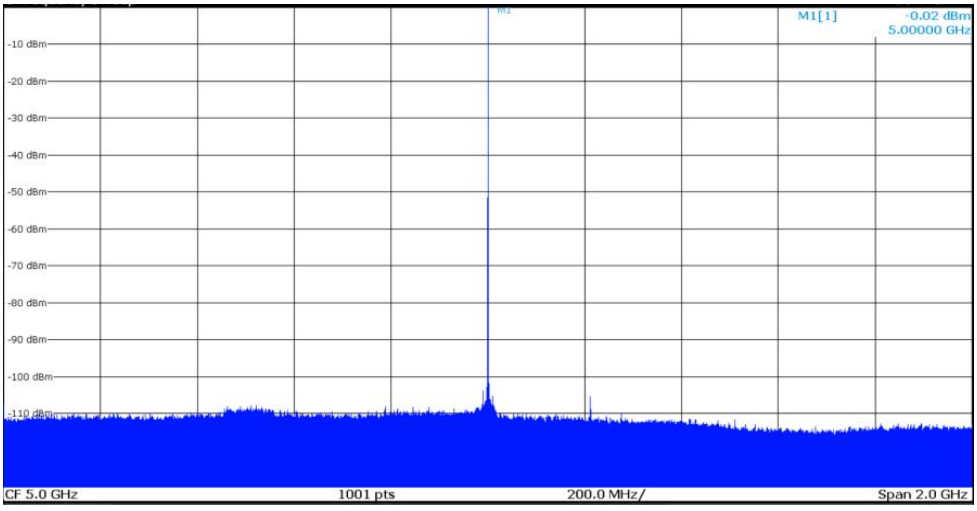


Fig.3.1 2GHz Sweep Width Non-harmonics

3.2 Broadband and high-power output

For H05 high-power options, typical values for the maximum output power are +22dBm for 20GHz, +20dBm for 40GHz, and +10dBm for 67GHz. For H06 enhanced high-power option, the output power is +30dBm (1W). When high-power input signals are required in your test, the required test signals can be obtained, with no external amplifier, and higher power accuracy and stability will be achieved.

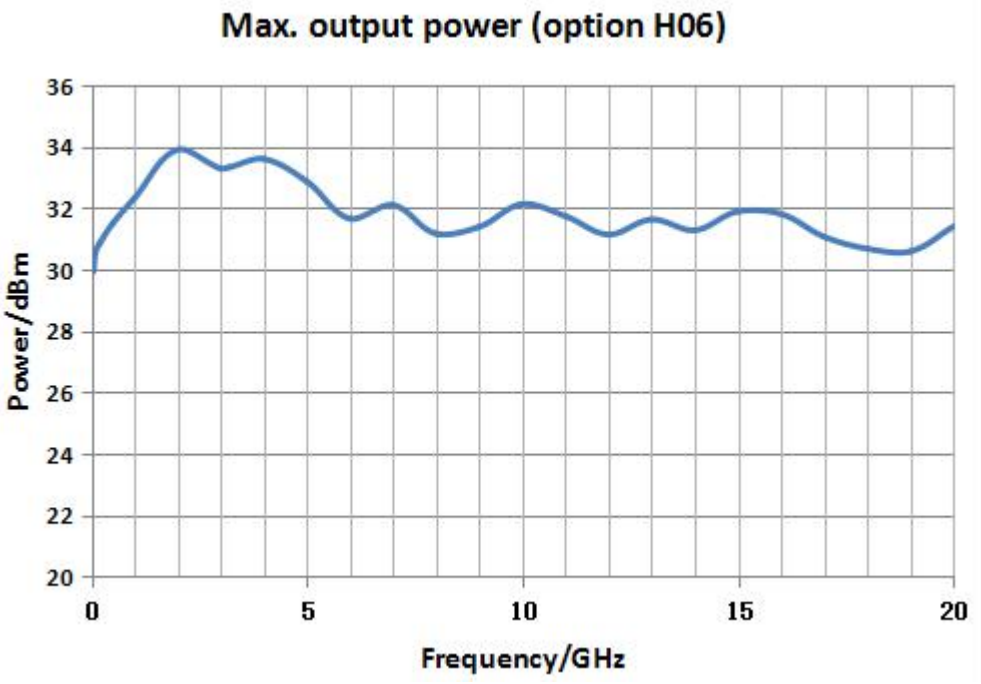


Fig.3.2 Max. Output Power of S1465D+H06

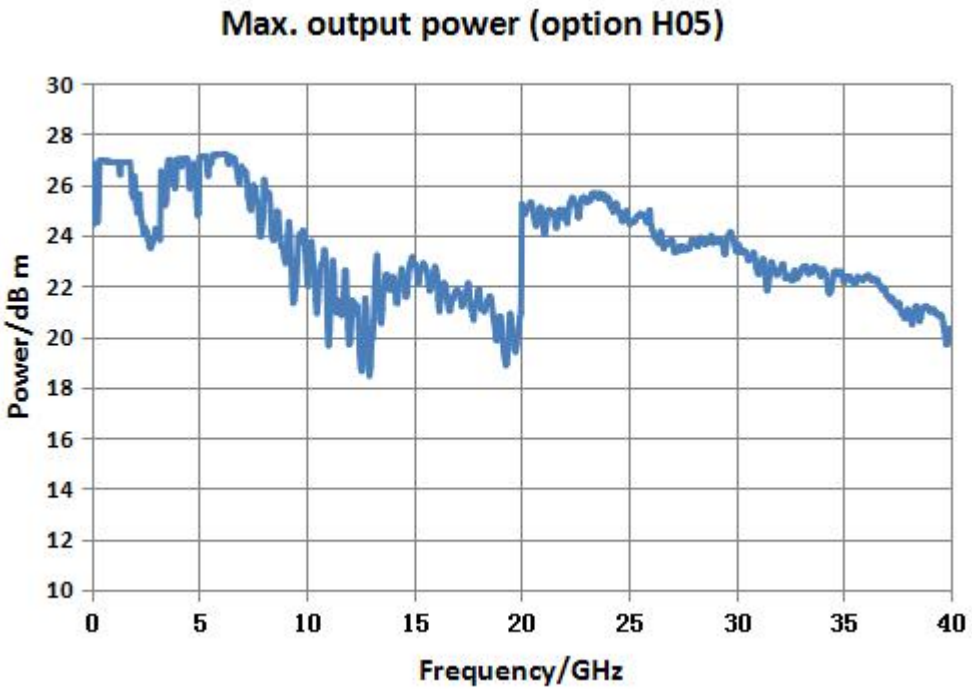


Fig.3.3 Max. Output Power of S1465F+H05

3.3 High stability frequency and power output

The stability is high for both the frequency and power of an output signal. Timebase aging rate is $\pm 5\times10^{-8}$/year, and for 10MHz high stability timebase, variation per year is not more than 0.5Hz. Both output power accuracy and stability are quite remarkable, i.e. after 15-day continuous power-on in the environment for a temperature cycle of 0ºC-50ºC, the power variation is less than 0.2dB at the same temperature, and rate of temperature change for the power is less than 0.01dB/ºC.

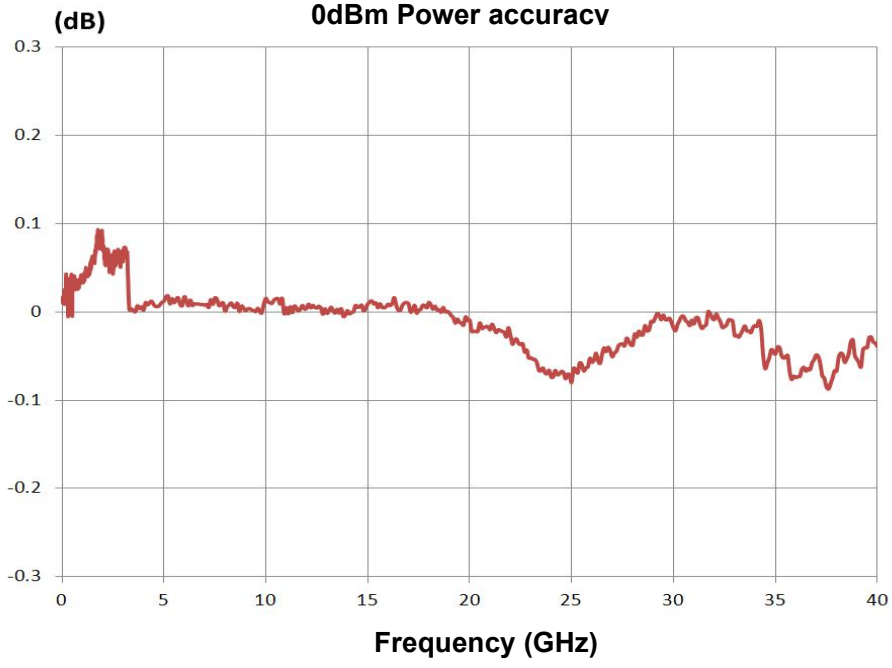


Fig.3.4 Power Accuracy

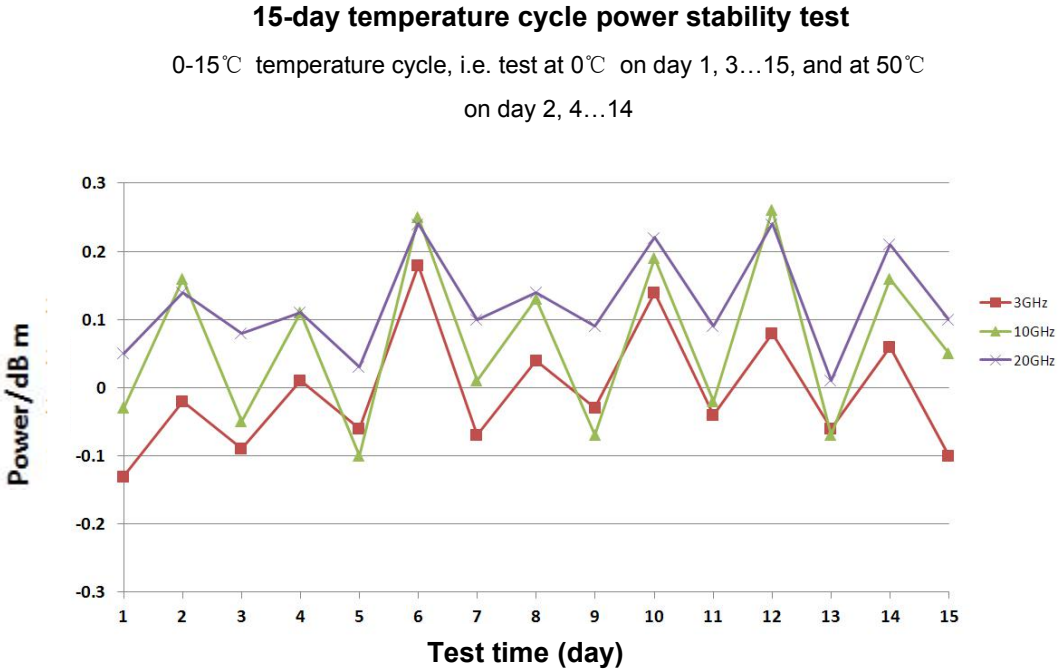


Fig.3.5 Power Stability Test

3.4 Convenient touch screen control

A 10.1-inch LED display screen of 1280×800 resolution shows the instrument status 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.

3.5 Complete frequency band serialization

For S1465C/D/F/H/L signal generators, the frequency ranges are 100kHz-10GHz/20GHz/40GHz/50GHz/67GHz, and for S1465L, the maximum selectable output frequency is 70GHz. Each model has various options available for function and performance extension. There is always one model suitable for you, no matter for metrology solutions or basic signal generators, only radio-frequency range test signals or millimeter-wave for signal frequency.

3.6 High-precision analog sweep

Full-band high-precision analog sweep function allows rapid sweep in your broadband test. In addition, step sweep and list sweep are provided for your other test requirements.

3.7 Super-high power dynamic range

A 150dB power dynamic range of -130dBm - +20dBm is provided as the best choice for testing a high-sensitivity receiver.

3.8 Excellent analog modulation

With the functions of AM, FM and ΦM, it supports internally and externally modulated resource input. For both the FM and ΦM, the modulation bandwidth is from DC to 10MHz, while linear and exponential modes are provided for AM, with the linear AM depth of more than 90%. An internally modulated signal generator, with the frequency range from DC to 10MHz, 0.1Hz resolution and 7 modulated waveforms, can output low-frequency signals directly.

3.9 High-performance pulse modulation

The depth of modulation is more than 80dB, with the rise and fall time of less than 10ns and the minimum pulse width of 20ns. Clock gate and various external trigger modes are supported. A standard internal pulse generator, with 6 pulse modes, pulse width from 20ns to 42s, and 10ns step, has the function of pulse train required in radar test.

3.10 Multiple control and function extension interfaces

There are USB, LAN, GPIB, monitor interface and other auxiliary interfaces, in which USB is used to transmit data, and connect with keyboard/mouse etc., while LAN and GPIB are used for program control, and monitor interface for external display.

4. Applications

4.1 Comprehensive performance evaluation for electronic system

S1465 series signal generators, with the frequency range from 100kHz to 67GHz, generate signals with high purity spectrum, high power output and remarkable stability, which can be used for comprehensive performance evaluation for such electronic systems as radar system, electronic warfare system, communication equipment system, and for solving such index test problems as band width, sensitivity, dynamic range and intermodulation distortion.

4.2 High-performance receiver test

S1465 series signal generators, with extremely low single side band phase noise and excellent non-harmonic suppression, can output perfect pure signals, used in phase noise, block and adjacent channel selectivity test for a high-performance receiver in the radar, electronic warfare system or communication equipment.

4.3 High-power device test

S1465 series signal generators, with the maximum output power of 1W, can test a high-power device, with no external amplifier, and overcome the loss of test system, with higher signal power accuracy and stability.

4.4 Durability test of electric equipment

All S1465 series signal generators, with the operating temperature range of 0-50°C, have high frequency and power stability, and can be used in the durability test of electric equipment where the instrument needs to be powered on for days.

4.5 Excitation signal and local oscillator substitution

S1465 series signal generators, with extremely pure signal quality and high output power, can be used for signal excitation for amplifiers, and as an ideal alternative for local oscillator in the tested equipment, such as transmitter and receiver etc..

5. Technical specifications[1]

5.1 Frequency properties			
		Frequency	N (internal YO harmonic number)

Frequency range	S1465C: 100kHz-10GHz S1465D:100kHz - 20GHz S1465D+H06: 10MHz - 20GHz S1465F:100kHz - 40GHz S1465H:100kHz - 50GHz S1465L:100kHz - 67GHz (Max. frequency of 70GHz)	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≤40GHz	4
		40GHz<f≤67GHz	8
Frequency resolution	0.001Hz		
Frequency switching time	<20ms (typical value[2])		
Timebase aging rate (typical value[3])	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 to +10dBm, 50Ω impedance	

5.2 Sweep properties

Sweep mode	Step sweep, list sweep, analog sweep, power sweep		
High-precision 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 100ms, within the maximum width of 100ms as specified)	

5.3 Power properties

Min. power	**Model**	**Standard**	**Option H01A/B**
	S1465C/D/F	-20dBm	-110dBm (-135dBm configurable)
	S1465D+ option H06	-10dBm	-90dBm (-125dBm configurable)

	S1465H/L	-20dBm	-90dBm (-110dBm configurable)		
Max. power (25±10°C)	**Frequency range**	**Standard**	**H01A/B programmable step attenuator option**	**H05 high-power output option**	**Options H01A/B+H05**
	S1465C/D				
	100kHz≤f≤20GHz	15dBm	15dBm	20[3]dBm	20[3]dBm
	S1465D+ option H06				
	10MHz≤f≤20GHz	28dBm	27dBm	---	---
	S1465F				
	100kHz≤f≤9GHz	12dBm	12dBm	20dBm	20dBm
	9GHz<f≤40GHz	12dBm	12dBm	17dBm	17dBm
	S1465H/L				
	100kHz≤f≤15GHz	5dBm	5dBm	17dBm	17dBm
	15GHz<f≤30GHz	5dBm	5dBm	13dBm	13dBm
	30GHz≤f≤67GHz	5dBm	4dBm	8dBm	8dBm

Power accuracy （25±10°C）	**Standard**				
	Power (dBm) / Frequency	>20	10 to 20	-10 to 10	-20 to -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
	S1465D+ H06 enhanced high-power output option				
	500MHz<f≤20GHz	±1.2dB	±0.8dB	±0.9	---
	H01A/B programmable step attenuator option				
	Power (dBm) / Frequency	>20	10 to 20	-10 to 10	-70 to -10	-90 to -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
	S1465D+ H06 enhanced high-power output option					
	500MHz<f≤20GHz	±1.2dB	±0.8dB	±0.8dB	±1.1dB	±2.0dB
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)					

5.4 Spectrum purity[5]

	Frequency	**Standard**	**H06 enhanced high-power option**
Harmonic (at +10dBm or Max. specified output power, whichever is lower)	100kHz≤f≤10MHz	<-25dBc	---
	10MHz<f≤2GHz	<-30dBc	<-25dBc
	2GHz<f≤6GHz (S1465B)	<-30dBc	---
	2GHz<f≤9GHz	<-55dBc	<-35dBc
	9GHz<f≤14GHz	<-55dBc	<-27dBc
	14GHz<f≤20GHz	<-55dBc	<-30dBc
	20GHz<f≤67GHz	<-50dBc (typical value)	---

Sub-harmonic (at +10dBm or Max. specified output power, whichever is lower)	100kHz≤f≤10GHz	Non
	10GHz<f≤20GHz	<-60dBc
	20GHz<f≤67GHz	<-50dBc

	Frequency	**Standard**	**Option H04**
Non-harmonic(At 0dBm, beyond 3kHz offset)	100kHz≤f≤250MHz	<-58dBc	<-58dBc
	250MHz<f≤3.2GHz	<-74dBc	<-80dBc

	3.2GHz<f≤10GHz	<-62dBc			<-70dBc		
	10GHz<f≤20GHz	<-56dBc			<-64dBc		
	20GHz<f≤40GHz	<-50dBc			<-58dBc		
	40GHz<f≤67GHz	<-44dBc			<-52dBc		
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
	250 MHz<f≤500MHz	---	---	-108	-126	-132	-136
	0.5GHz<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≤40GHz	---	---	-69	-89	-98	-98
	40GHz<f≤67GHz	---	---	-64	-84	-92	-92
	H04 ultra low phase noise option						
	100kHz≤f≤250MHz	-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≤40GHz	-31	-60	-73	-91	-108	-108
	40GHz<f≤67GHz	-26	-54	-68	-85	-102	-102
5.5 Modulation properties							
Frequency modulation (10MHz<f≤50GHz, option H02A)	Maximum deviation: N×16MHz (N: YO harmonic number) Accuracy (at 1kHz, N×20kHz≤deviations<N×800kHz): <± (3.5%× set frequency offset +20Hz) Modulation rate (3dB band width, 500kHz frequency offset): DC-10MHz Distortion (at 1kHz, N×20kHz≤ distortion <N×800kHz): <1%						
Phase modulation (10MHz<f≤50GHz,	Maximum deviation: Normal mode: N×16rad (N: YO harmonic number)						

<table>
<tr><td>option H02A)</td><td colspan="3">Broadband mode: N×1.6rad (N: YO harmonic number)
Accuracy (at 1kHz, N×0.2rad≤deviations<N×8rad, normal mode): <± (5% of deviation +0.01 rad)
Modulation rate (3dB bandwidth):
Narrowband mode DC - 1MHz (typical value)
Broadband mode DC - 10MHz (typical value)
Distortion (at 1kHz, N×0.8rad≤deviations<N×8rad, THD): <1%</td></tr>
<tr><td>Amplitude modulation (10MHz<f≤50GHz, option H02A)</td><td colspan="3">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%</td></tr>
<tr><td rowspan="5">Pulse modulation (option H02B)</td><td></td><td>500MHz - 3.2GHz</td><td>>3.2GHz</td></tr>
<tr><td>Switch ratio</td><td>>80dB</td><td>>80dB</td></tr>
<tr><td>Rise and fall time</td><td><20ns</td><td><20ns</td></tr>
<tr><td>Min. pulse width for internal fixed amplitude</td><td>1μs</td><td>1μs</td></tr>
<tr><td>Min. pulse width for non fixed amplitude</td><td>0.1μs</td><td>0.1μs</td></tr>
<tr><td rowspan="5">Narrow pulse modulation (option H02C)</td><td></td><td>50MHz - 3.2GHz</td><td>More than 3.2GHz</td></tr>
<tr><td>On/off ratio</td><td>>80dB</td><td>>80dB</td></tr>
<tr><td>Rise/fall time</td><td><15ns</td><td><10ns</td></tr>
<tr><td>Min. pulse width ALC on</td><td>1μs</td><td>1μs</td></tr>
<tr><td>Min. pulse width ALC off</td><td>30ns</td><td>20ns</td></tr>
<tr><td>Internally modulated signal generator (option H02A/B/C)</td><td colspan="3">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 sinusoidal wave, double sine, sweep sine wave; 0.1Hz-100kHz for square wave, triangular wave and sawtooth wave.
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</td></tr>
<tr><td colspan="4">5.6 General properties</td></tr>
<tr><td>RF output port</td><td colspan="3">S1465C: N (female), impedance: 50Ω
S1465D: 3.5mm (male), N (female) (option H91), impedance: 50Ω</td></tr>
</table>

	S1465F: 2.4mm (male), impedance: 50Ω S1465H/L: 1.85 mm (male), impedance: 50Ω
Dimensions	W×H×D＝435mm×178mm×498mm (excluding. handle, foot mat and footing) W×H×D＝517mm×192mm×550mm (including handle (option H93), foot mat and footing)
Weight	<28kg (as per model and option configuration)
Power supply	100-120VAC, 50-60Hz, ±5%; or 200-240VAC, 50-60Hz, ±5% (self-adaptive)
Power consumption	Less than 350W
Temperature range	Operating temperature: 0 to +50ºC; storage temperature: -40 to +70ºC
Humidity	85% or better

Notes:

1. S1465 series signal generators, after stored for 2h at the ambient temperature and preheated for 30min, meet all performance indexes, within the given operating range.
2. Typical value is a supplementary item given with a set value, only for reference by users.
3. +16dBm for S1465B
4. Rating is a predicated performance, which is useful in product description, but not covered by product warranty.
5. Spectrum purity index is in dot frequency non modulation mode.
6. The test power is set to +15dBm for SSB phase noise of 100kHz≤f≤250MHz. For option H06, the frequency range is 100MHz≤f≤250MHz, and the frequency range less than 100MHz is not guaranteed.

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